THE IRON TRADE REVIEW

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THE IRON TRADE REVIEW.

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CLEVELAND, O., OCTOBER 29, 1891.

THE WEEK IN IRON CIRCLES.

General Features.

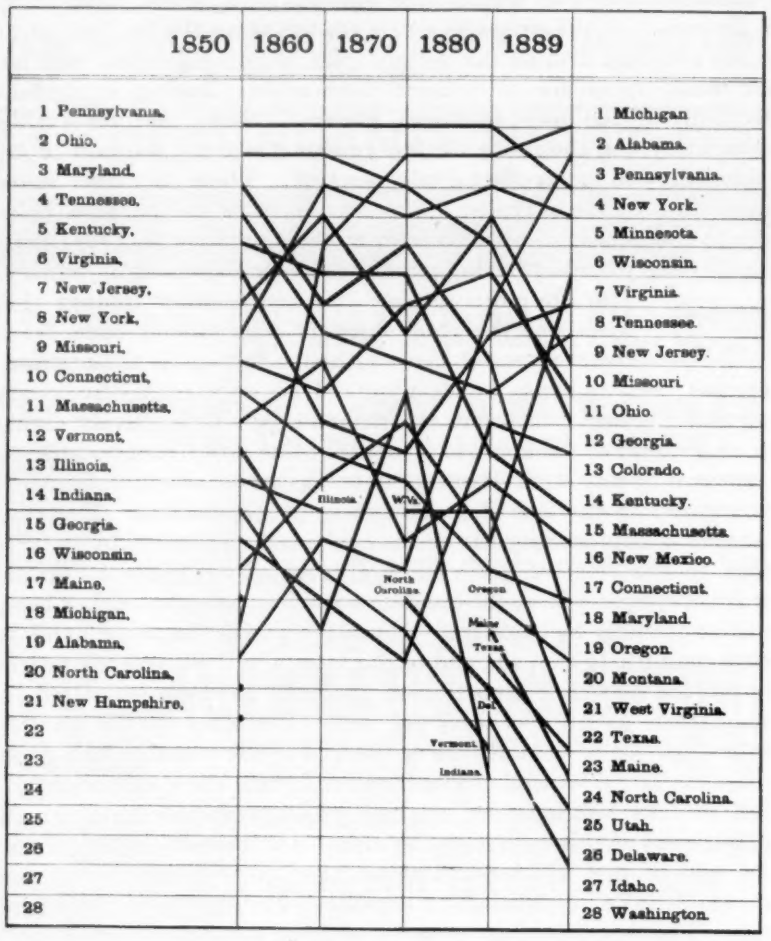
The somewhat anomalous spectacle is presented of the railroads taxed to their utmost to meet existing demands upon their carrying capacity, while at the same time there is little, if any, anxiety to place orders for equipment. Perhaps an explanation is found in the fact that the investing public is taking very little interest just now in railroad bonds or stocks of any kind, notwithstanding money grows easier each week. Probably this state of undue conservatism will continue to prevail until after the turn of the year, when the usual liquidation will have taken place and the dividend accounts will have been figured up. The iron markets, in the meantime, continue in the even tenor of their way, with occasional weak spots, but generally showing a tone of strength. Foundries are doing only fairly well, and are disappointed that business does not respond more promptly to the improved influences abroad in the country. Expectations are general, however, that as the proceeds of the crops are more freely distributed, debts are paid, and the purchasing ability of the masses increased, all forms of iron business will feel the effects. Southern irons have been selling in Cincinnati at a rate fully equal to the rate of production, and prices realized are better than have been going. It is likely that current sales will average from thirty cents to fifty cents per ton higher than the current sales of an equal period two months ago. Special brands of grey forge have been sold for delivery through six months of next year at $10.50 cash at furnace. Other sales are reported at $10.25 cash, while $10 is still accepted for this year's delivery. For No. 1 foundry, next year's delivery, $12.50 cash at furnace has been offered. Among Ohio furnaces the demand for near-by deliveries is rather slack and some accumulation of stocks is noted. Makers are not disposed to enter into contracts for next year's deliveries. A good degree of activity continues in the Chicago market, though most of the large deals which have been pending have been closed and business going is now mainly for lots of small size. The firmness previously reported on the part of Southern coke furnaces, continues with the result that transactions in this direction are being materially cut down. There has been practically no change in prices at which Northern coke irons are selling and consumers in the Chicago district are unwilling to pay any premium in order to use coke metal made in the South. They have discovered during the past few years that they can get along without Southern irons whenever necessary. Northern coke irons continue to be sold freely in large and small lots for long scattered deliveries running in many cases through the entire year of 1892, these deliveries being granted freely without any advance in price. Lake Superior charcoals remain inactive, various reports of cut prices continue to come in. Some companies are holding for $18 to $19 and getting it, on small lots, the open market being $17 at Chicago. The Louisville market remains quiet, with few sales. Some furnaces are willing to sell for delivery running to July, at basis of $10.25 for grey forge at furnace, and some purchases have been made upon this basis. There is a difference in the value of some grades, especially noticeable in No. 1 Foundry—one furnace holding at $12.75, others selling freely at $12.00 cars furnace. Almost every trade report heard at Detroit indicates an improvement; nor can the pig iron business be considered an exception, for there certainly are better transactions being made regarding both quantity and delivery than existed the first part of the month, that is, the extended deliveries which were granted then would have to be paid for now. While prices as a rule are the same, the inclination to advance and hold firm on the sellers' part is more general, and far fewer weak spots are at present discernible. Buying at Buffalo is decidedly of the hand-to-mouth variety. Sales indicate a trifle more activity, but the probabilities are that it is only a spasm to be quickly followed by another little reaction. There is rather more firmness in the tone of the St. Louis market so far as Southern coke irons are concerned. Reported sales of choice brands of grey forge on basis of $10.50 cash, Birmingham, for delivery beginning in January.

The Local Situation.

The grain-ore see-saw has had another innings this week, and the grain shippers' offer of four cents from Duluth has not been without effect upon the ore rate. There has been in consequence a marked advance, eighty-five cents being the Escanaba rate, but the demand is comparatively light, both on account of the absence of ore to come down, and because of the absence of any such inquiry for ore as would warrant the producers to sell, in the face of an advancing freight market. That the ore season is approaching the end is evidenced, moreover, by the difference in the relative grain and ore rates. Four cents for grain from Duluth equals $1.49 for ore, but no such money has either been offered or is likely to be offered this season. On the other hand, it is more than likely that the end of the month will witness the retirement for the season of a portion of the lake tonnage, estimated in some quarters as high as forty per cent. Certainly all the smaller boats will go out of commission at the end of the month, and a good many of the larger as well. The October figures show a decided falling off in lake shipments of ore over the corresponding month in 1890, but even at this reduction the month's shipments include about 75,000 tons of ore, which could never have come down but for the weakness in lake freights, which prevailed during almost the entire month. The season's figures will, without a doubt, remain well within the estimates hitherto published, but may, on the other hand, show quite a serious falling off. The pig iron market remains quiet, dull and firm. The furnaces keep on making iron in a desultory sort of way, and keep on selling it as fast as made at the market price, which, as has been said before, is the lowest seen for many a year. This process, in some instances, where the furnaces are favored in the matter of location, means the getting of a new dollar for an old one, but in not a few cases there is an actual loss in the production of iron at the present price, and yet the fixed charges and the probable loss of custom combine to keep the stacks in blast. The furnacemen prefer to keep on selling, even at a loss, if they must, to the accumulation of stocks, which would create a tendency to "dump" the market in the event of an advance. It goes without saying that this situation is one that pleases the consumers of pig iron immensely, because all manner of manufactured products are comparatively high, much higher than the relative price of the raw material; and as long as they are enabled to buy all the spot iron they want at the present prices, they will hardly make an effort to advance the price by making contracts for iron to be delivered four or six months hence, when by so doing they would not only have to pay more, but would place themselves in the position of having to bid against each other. That the furnaces well understand the situation appears by their persistent refusal to sell iron for any long time-time delivery at the market price. This is particularly true of Bessemer iron, which, while selling barely at cost for the spot article, is held very firmly by the makers for all futures. Some of the Eastern mill men are engaged in engineering a speculative movement in Bessemer iron, and the producers do not feel like pulling the chestnuts out of the fire for their ingenious customers. In other respects the iron market is without any leading features. The ten per cent, advance has been acceeded to by all the furnaces in the two valleys, thus adding to the cost of producing pig iron without an atom of return in any way.

THE RACE OF THE IRON ORE PRODUCERS.

From Mr. John Birkinbine's very full and complete report to the Census Office on the iron ore industry, we have made up the accompanying chart showing the rank of the several States as producers of iron ore in the census years of 1850, 1860, 1870, 1880 and 1889. The changes wrought in the past twenty years are very clearly shown in the extreme fluctuations of some of the lines. For instance, Michigan, which in 1850 occupied eighteenth place, sprang to fifth in 1860, then to second in 1870, which she held for the succeeding ten years, and then, in 1889, stepped to the head of the column. Alabama, beginning nineteenth in 1850, went to fifteenth in 1860, fell back to sixteenth in 1870, jumped to seventh in 1880, and crowded Pennsylvania out of second place in 1889. Ohio held second place both in 1850 and 1860, went to third in 1870, to fifth in 1880 and to eleventh in 1889. Pennsylvania, after holding first place for thirty years, drops to third in 1889. Indiana, beginning at the fourteenth notch in 1850, shot down to eighteenth in 1860, sprang to tenth in 1870, fell to twenty-third in 1880, and then disappeared as an iron ore producer. Virginia began sixth and ends seventh, with wide fluctuations in the meantime. Maryland was third in 1850, seventh in 1860, fifth in 1870, ninth in 1880, and eighteenth in 1889. Quite a group of States appeared in 1889 for the first time as having an iron mining industry.



Two States which produced over 100,000 long tons of iron ore in 1850 were increased to five States in 1860, to seven in 1870, to nine in 1880, and to thirteen in 1889. One State exceeded 500,000 tons in 1850 and 1860, two in 1870, four in 1880, and six in 1889. Pennsylvania is the only State reported as reaching an output exceeding 1,000,000 tons until 1880, when three States exceeded this amount, and in 1889 four States were numbered among the great producers. In 1870 and 1880 Pennsylvania reported over 2,000,000 tons, but in 1889 fell below that figure. In the latter year Michigan produced nearly 6,000,000 tons.

WELSH TINPLATE MAKERS AND THEIR CHICAGO CHAMPIONS.

Without desiring to harrow up the feelings of the Free Trade editor of the *Un-American Artisan*, of Chicago, or to re-open a rather delicate subject, we cannot refrain from quoting the following from the London (England) *Financial Times*, of recent date:

Time alone is wanting to build up the tinplate industry in America, but it is to be feared that the Welsh manufacturers are deceiving themselves if they imagine that a decade must elapse before any impression can be made on their business by rivals across the water. A year or two, however, will certainly intervene before the competition can be really dangerous. Long ere that time it is to be hoped that the American people will have torn up the McKinley law root and branch, or at least have pruned judiciously, and signs are not wanting that this will come about. The Welsh manufacturers have some strong-siding champions in Chicago and elsewhere.

It was another London paper, the *Iron and Steel Trades Journal*, which recently stated that the editor of the Chicago paper "is a frequent visitor to Europe, and the appreciation of his efforts is shown by the large number of advertisements from Welsh works appearing in his paper," and no wonder, for the *Artisan* "is almost the only trade paper in America whose editor has taken a bold stand against the tinplate clause in the American tariff bill." The *Artisan* should pray to be saved from its friends.

PRESENT STATUS OF THE WORLD'S FAIR.

Very interesting figures regarding the present status of the World's Fair have just been given out by the management. These data are for the first time given to the public and are well worth careful perusal. The following table shows the names, dimensions, capacity and cost of the various buildings:

Buildings.	Dimensions in feet.	Area in Acres.	Cost.
Mines and Mining	350 x 700	5.6	$ 260,000
Manufactures and Liberal Arts	787 x1687	30.5	1,000,000
Horticulture	250 x1000	5.8	300,000
Electricity	345 x 700	5.5	375,000
Woman's	200 x 400	1.8	120,000
Transportation	250 x 960	5.5	280,000
Administration	260 x 260	1.6	450,000
Fish and Fisheries	163 x 363	1.4	200,000
Annexes (2)	135 diam.	.8	
Agriculture	500 x 800	9.2	540,000
Annex	328 x 500	3.8	200,000
Assembly hall, etc	450 x 500	5.2	
Machinery	500 x 800	9.8	1,200,000
Annex	490 x 551	6.2	
Power house	80 x 600	1.1	
Fine Arts	320 x 500	3.7	500,000
Annexes (2)	120 x 200	1.1	
Forestry	200 x 500	2.3	100,000
Saw Mill	125 x 300	9	35,000
Dairy	95 x 200	.5	30,000
Live Stock (3)	53 x 330	1.3	150,000
Live Stock Sheds		40.0	
Casino	175 x 300	1.2	*150,000
		144.8	$5,890,000
United States Government	350 x 420	3.4	400,000
Battle Ship	348 x 69.25	.2	100,00
Illinois State	160 x 450	1.7	250,000
		150.1	$6,640,000

It will thus be seen that not less than 150 acres will be enclosed by what may be termed the official buildings, but with the enlargements, annexes, State buildings, etc., a much greater area than that will be under cover. The total cost of the Exposition structures is estimated by the Grounds and Buildings Committee at $7,295,000. At least seventy-five State and foreign buildings will also be erected.

But the expenses are only begun with the cost of the buildings. According to a recent report by the same committee the following amounts will be required for various improvements:

Grading, filling, etc	$ 450,000
Landscape gardening	323,490
Viaducts and bridges	125,000
Piers	70,000
Waterway improvements	225,000
Railways	500,000
Steam plant	800,000
Electricity	1,500 000
Statuary on buildings	100,000
Vases, lamps and posts	50 000
Seating	8,000
Water supply, sewerage, etc	600,000
Improvement of lake front	200,000
World's congress auxiliary	200,000
Construction department expenses	520,000
Organization and administration	3,308 563
Operating expenses	1,550,000
	$10,530,053

Adding to this the amount estimated to be necessary for buildings ($7,295,000), the grand total sum to be expended by the Exposition Company stands at $17,825,053.

In view of the showing given above a statement of the Exposition's finances is interesting in this connection:

Stock subscriptions	$ 5,608,110
City of Chicago bonds	5,000,000
Prospective gate receipts	10,000,000
Concessions and privileges	1,500 000
Salvage	1,000,000
Interest on deposits	27,035
	$23,135,145

To the resources will be added future interest on bank deposits and future subscriptions to stock. Subscriptions are coming in daily, and the amount which will thus be realized is certain to be large though how much it will be cannot, of course, be estimated now even approximately. In order to anticipate the collection of the above subscriptions, etc., and provide the ready money, it is in contemplation to ask a loan of $5,000,000 from the Government, pledging the gate receipts as security. The total disbursements to October 15, for all purposes, have been $1,459,080. The estimated total expenses to be borne by the Exposition Company are:

Grounds and buildings	$13,966,490
Organization and administration	3,308,563
Operating expenses, May to November, 1893	1.550,000
	$17,825,053

The total appropriations by the various States and Territories

*Including cost of pier.

for representation at the Exposition are $2,695,000 to date, and private subscriptions in States not officially represented may reach $1,000,000 more. A partial list of foreign nations that will participate shows a total of thirty-one nations and fourteen colonies, and appropriations aggregating $3,630,000.

AMERICAN CUTLERY TO THE FRONT.

Concerning the growth of the American cutlery manufacture, the following paragraph from the *Stoves and Hardware Reporter* (St. Louis) is in direct confirmation of the admission recently made by *Kuhlow's German Trade Review*, as quoted in these colums last week:

The Ottumwa (Ia.) Cutlery Works have increased their facilities for the manufacture of cutlery fully five-fold. Formerly they employed one hundred hands; now five hundred are engaged in the production of cutlery at these works. Despite predictions to the effect that cutlery would show a radical advance, the prices of the kind of cutlery about which such dire predictions were made, are lower than they were a year ago. It is estimated that about 40 per cent. of the production in this country is of the kind of goods that were formerly imported. In eight months of the present year, the foreign imports were only about one-third of what they were for the corresponding months of 1890. The outlook for American cutlery could not be brighter than it is at the present time.

The other side of the picture is found in the fact (stated by *Kuhlow's*) that "the falling off in the export which became apparent for the first six months after the McKinley Bill came into force was not so large but what it could not be accounted for by the previous increase in the export. To-day however we can plainly see that neither the Westphalian nor the Thuringen cutlery will be able to hold its place in the American markets, since it is exactly for this very branch of industry—with the exception of sheet iron which Germany scarcely exports to America—that the increased tariff of the McKinley Bill presses hardest, so hard in fact that it amounts to a prohibitory duty."

While we cannot but join with our Berlin contemporary in regretting the hard lines into which the German cutlery trade has fallen, we can scarcely go with it in the hope that "our good friends on the other side of the Atlantic will see the mistake in their political economy in time to spare this branch of industry [in Germany] from being involved in utter ruin." It is not at all likely that with the rapid growth of the American cutlery industry the "good people" on this side of the Atlantic will very soon discover their "mistake."

More Activity in Steel Rails.

There has been more activity, and we are able to record sales aggregating 50,000 tons, of which 40,000 tons were taken by Eastern mills, while 10,000 tons went to Pittsburgh. All the sales by Eastern mills have been for renewal on leading roads in New England, New Jersey and Pennsylvania. They include one lot of 6,000 tons for a New England road famous for its rigid specifications, in consideration of which the mill receives an advanced price. This order has led to some friction. Some of the mills are now pretty well off for early Winter work, and it is evident from the report of the Board of Control either that the works pick up a good deal of business in the shape of small orders or that they keep their sales unusually quiet. On October 1, according to the official data, the sales aggregated 976 536 tons of rails of 50 lbs and over, against 894,798 tons on September 1 and 860,755 on August 1. September therefore, added 81,738 tons to the order books, which is more than the meager reports received during that month would have indicated. Deliveries, of course, are larger, being at a 100,000-ton rate monthly. The figures stand as follows: Up to July 1, 145 423; August 1, 584 938; September 1, 699,027 and October 1, 799 956 gross tons. This does not, of course, include light rails, under 50 lbs. per yard, which will considerably swell the total, but which are not subject to the arrangement entered into by the mills. The official reports do not give the sales for delivery in 1892, nor are these figures expected until late in this year. In many cases it remains optional with the mills when they roll the material contracted for, and it is possible that some of them will turn out some of the rails contracted for delivery next year during the balance of this year. In spite of all rumors to the contrary, the price remains $30, at mill, nor is there any likelihood of concessions in standard sections. The mills never have had as strong an arrangement as they are now working under. It has stood the test of many weary months of depression, and can easily outlast any further period of dullness to which it may possibly be subjected. The Rail manufacturers are all convinced that 1892 will bring them a very active year.—[Iron Age.

A Novel Type of Lake Steamer.

The Lake Superior Iron Co. has ordered of a Cleveland ship-building company two large steel steamships of a new pattern. They will be known as "monitors," being a modified form of the whalebacks. The boats will have a keel, but the stem will fall back rapidly from the water line. The side will "tumble home," and the decks will be slightly rounded. On each side of the hatches is a gangway two feet wide, running lengthwise of the boat. A turret forward will contain the wheel-house and chart room, and the quarters of the officers and crew will be in the after part of the boat. The two steamers will be ready for sea at the opening of navigation next spring.

WORLD'S FAIR NOTES.

More than one and a-half million pounds of steel and iron will enter into the construction of the Mines and Mining Building.

The imitation battleship "Illinois," at the naval pier, in the Exposition grounds, is now rising from the water. Work is progressing satisfactorily on the hull. The deck will measure over all 348x69¼ feet. This structure is to cost $100,000, and is the most original illustration of naval architecture ever worked out.

One of the largest bicycle factories in America has written to Chief Smith, of the Transportation Department, that it will exhibit at the Fair "bicycles and tricycles of every style of the trade, showing the rise and progress of the art of making 'wheels,' from the first 'bone shaker' built in this country up to the highly finished 'safety' of the present day."

A stock company with a capital of $100,000 has been formed to place a paper exhibit at the Columbian Exposition. Every American paper maker or American manufacturer of paper-making machinery will be allowed to take stock. The entire capital has already been secured, but the pledges will not be called for until the outsiders have been given a chance, in order to do away with any idea of a money-making scheme. A committee of five has been appointed by President M. J. Fitch to take the matter in hand and to send a representative to the meeting of the Boston Paper Trade Club on the third Wednesday in November.

A $10,000 model of a stamp mill for reducing copper, now the property of the State Museum of Michigan, will be shown at the fair. This model was made and presented by the Calumet & Hecla Copper Co.

There have been distributed 10,000 of the lithographs of Machinery Hall, of which New York City and State have received the largest number. Over 1,000 requests are now on file from leading manufacturers, merchants and importers of New York City and Eastern States.

The Atlantic Transport Co., operating a line of steamers between London and New York, has agreed to carry exhibits from London to either New York, Philadelphia or Baltimore free of charge, except the actual expenses of loading and unloading. This generous proposition makes it possible for European exhibitors to have their displays brought to the American seaboard practically free of charge.

J. Allen Hornsby, Secretary of the Department of Electricity, who was sent to Frankfort-on-the-Main to study the Electrical Exposition there, has made a report, which shows that out of compliment to the Columbian Exposition the Frankfort Exposition was kept open a fortnight longer than was originally intended, in order to give Mr. Hornsby a chance for thorough investigation. Secretary Hornsby writes that there is electrical apparatus on exhibition at Frankfort which, when put in operation, will cause the eyes of American electricians to open in wonderment.

The Department of Publicity of the Exposition sent out during September 253 566 separate pieces of printed matter concerning the Fair, an average of 9,762 pieces for each of the twenty-six working days of the month. Of this matter 199,267 pieces were in English, 3,549 in German, 3,582 in Spanish, 2,550 in French, 1,040 in Portuguese, 1,144 in Swedish, 899 in Danish, 214 in Italian, 100 Dutch, and 24 257 printed pictures of buildings and ground plans of Jackson Park, and 2,678 lithographs of Machinery Hall. There were also sent out 888 electrotypes for use in various publications in different parts of the world.

A Large Hot Shearing Machine.

There has recently been put in service at the steel works of Messrs. Spencer, at Newburn, England, an immense shear for cutting ingots while hot. This machine is capable of shearing an ingot 30 inches wide by 12 inches thick. The bloom is carried to the machine over feed rolls similar to those used in the ordinary rolling mill and by them is carried over the anvil block and brought against a hydraulic stop which can be adjusted to any position to give the proper length of bloom. The upper shear slide is actuated by a pitman attached to a heavy horizontal shaft overhead, which in turn is driven by gearing. To keep the ingot flat upon the anvil block so that it cannot tilt and thus cut off the ends of the slab at a bevel instead of a square, a hydraulic foot is brought down upon the bloom and made to hold it while the shearing operation is carried on. It takes about three seconds for the shearing knife to pass through a bloom of the size mentioned. Everything about the machine is made enormously heavy. The four cap bolts on the upper shaft are each 10½ inches in diameter and the eccentric bearing on that shaft by which the pitman is driven, is 20 inches in diameter. Such enormous strength would not be necessary if the blooms were always very hot, but the machine has been made heavy enough to shear a bloom of the size mentioned when it is a dull red, or even a blue hot at the ragged end, in which latter case the resistance in shearing approaches close to that of a cold slab.

Coal Burned on Atlantic Steamers.

The steamship "Majestic," on her first record passage, is said to have maintained a speed of 20.1 knots, and burning 220 tons of coal each day; her engines indicated 29,500 H. P. The "City of Paris" is accredited with 260 tons of coal during the voyages which she is at present making, and her average speed is said to be about 19¼ knots; but her indicated horse-power is less than that of the "Majestic." Reckoning 2,240 pounds per ton, the coal consumption of the "Majestic," according to the foregoing figures, is 1 05 pounds per indicated horse-power, which shows a remarkable economy of fuel; in fact, these figures would seem to indicate that there is a mistake somewhere. It is claimed that during a recent voyage the coal consumption of the "City of Paris" was only 240 tons per day for both main engines and all auxiliary power. But her total horse power and the necessary deduction for the auxiliary power is not given.—[American Machinist.

AN UNDESCRIBED PHENOMENON IN THE FUSION OF MILD STEEL.

At the recent meeting of the British Iron and Steel Institute, Mr. F. J. R. Carulla, of Derby, read the following paper on "An Undescribed Phenomenon in the Fusion of Mild Steel":

The discrepancies in regard to the melting points of certain iron and aluminium alloys, as stated by different observers— a matter to which forcible reference was made by Mr. Hadfield in his paper on aluminium steel, which appeared in the second volume of last year's *Transactions* of this institute—has induced the writer to bring to your notice a circumstance which, whilst he does not profess to say explains the variations referred to, may yet have some bearing upon them, and is otherwise of interest to iron and steel users and manufacturers. The phenomenon in question is the remarkable one that the interior of a piece of mild steel may be raised to the fusing point whilst the outside remains in the solid state, just as if one were to try to melt an iron tube, closed up at each end, and filled with some metal of a lower melting point than iron, in which case the heat would penetrate through the iron and liquefy the interior long before the tube itself would be affected, and if there should happen to be some outlet or weak place in the tube, it might be left completely empty. Bessemer steel makers, especially those who may have employed the system of upward casting, will be reminded of the shells of ingots accidentally obtained in the melting shop by an incautious act, produced however, by a different process, viz., by the cooling of the outside whilst the interior of the ingot remains in a molten state. Shells have also been obtained by altering the nature of the exterior of a piece of cast iron, so as to leave the interior more fusible than the outside. Henry Horne, so long ago as the year 1773, in his *Essays, concerning Iron and Steel*, after describing Reaumur's method of softening cast iron by means of a mixture of calcined bones and powdered charcoal, goes on to say:—"I have myself tried the truth of the hypothesis in a rough way, as far as nealing, or merely reducing, has any concern in the matter, by a great number of experiments, two only of which I judge necessary to recite by way of specimen. I had several small ingots of cast iron, about ¾ inch thick; these I put into a crucible covered all round with the matter above described, and in that situation commited them to the fire, where I suffered them to remain a sufficient time, then took them out, and gave them a strong heat, when the exterior parts were become capable of bearing even a welding heat, while the interior suffered an easy dissolution, and ran out into the fire. I ran some other ingots in the form of pistol barrels, which having treated in the same manner, the same consequence ensued; the exterior cases, as before, remained firm and stable, while the interior dissolved and ran out, and left cases in the entire form of pistol barrels." The instance, however, to which this paper refers is altogether different from those just mentioned, and it will be perhaps best to give an account as accurately as can now be remembered of the circumstances under which the observation was made.

Some years ago the writer was engaged at Sheffield in the operation of melting, in pots or crucibles, steel intended for the manufacture of wire ropes, the material charged being mainly Bessemer scrap of varying carbon contents, which, however, by the process became averaged, and the resulting product attained a uniformity that was much appreciated for the purpose named. It happened on one occasion that a crucible gave way in the furnace just as fusion was nearly complete, the greater part of its contents running out into the fire. The melter happened at that moment to bring the crucible out, and what he supposed to be an empty pot was found to contain a number of shells having the shape of the pieces of steel originally charged, and showing that the interior of these had undergone fusion, whilst the outside envelope remained solid—a fact leading to the conclusion that the melting point of the interior mass was lower than that of the exterior coating. Two of the pieces found in that crucible are before you. The larger piece, about 3½x 1⅝" square, must originally have weighed about 41 oz. It is now a shell of 14½ oz. The smaller piece, about 3½x2¼x⅞", will originally have weighed approximately 26¼ oz.; its shell now only weighs 8¾ oz. From these figures it may be seen that the larger piece lost by fusion of its interior about 26½ oz., or 64½ per cent. of the whole, whilst the smallest piece lost 17½ oz., or 66½ per cent. of the whole in the same manner—two results that agree in a remarkable way. It would therefore appear from so close a coincidence as if mild steel of the dimensions given, having a sectional area of from 2 to 2½ square inches, possessed a coating or skin of about one-third of the whole mass with a higher melting point than the remaining two-thirds forming the interior. How far such a fact may have affected the observations on the melting points of steel and aluminium alloys referred to at the commencement of this paper it is impossible to say, but it will be perceived that if the same heterogeneity occurred in their case as that which has been described, discrepancies in a number of observations are easy to account for. It is to be regreted that the composition of the steel as it originally went into the crucible is unknown. Scrap was being melted, much of which would be from cut-up rail ends, but the square piece looks like a portion of a billet which might have been of a milder steel. At any rate, both shells now only contain a mere trace of carbon, the amount not reaching to 0.1 per cent., so that their resistance to fusion can be easily understood. The phenomenon referred to is, however, interesting in other ways, besides in its relation to the subject of melting points. Some such result might, for instance, be expected from the facts communicated to this institute in 1881 by Mr. Stubbs, and subsequently corroborated by Mr. Snelus, that carbon, sulphur and silicon become concentrated in those portions of the ingot that remain fluid the longest. This, of course, is the interior, so that from the very commencement the outside of the ingot acquires a skin of a less fusible nature than that of its internal mass. In a more or less marked degree this liquation of the elements may be expected to occur in all steel that has been cast into ingot molds, for the same cause is likely to operate in every case, whatever the composition of the steel may be. Of course subsequent treatment at the mill and forge, by subjecting the outside of the material to the oxidizing action of the air, will intensify the characteristics that make the outside of the ingot less fusible than the interior, but that the skin, even in the hardest steel, is of a different nature and tougher than the interior, is a fact that will be confirmed by those who are in the habit of handling tool steel, which, by nicking or just cutting through this skin, may easily be broken, when often the bars bend if struck without such preparation.

What has been explained also brings into prominence the fact that, by turning and planing rolled or forged pieces of machinery, these are weakened in a disproportionate degree as the most valuable part of the piece is removed. It is obviously advantageous that where a steel forging can be finished under the hammer this should be done. Doubtless, finishing by means of moulds so as to bring the article as near to the ultimate shape required as possible is the best course to pursue. The hydraulic press will no doubt play an important part in this direction at no distant date, although much has already been done by working in this manner under the steam hammer. The writer, for example, remembers the manufacture of large screws for holding armor-plates to the sides of vessels being carried on many years ago at the Atlas Works, in Sheffield. These screws, whose thread was forged under moulds, had the original skin of the bar left all over them, the forgings being further protected by galvanizing. It is not forgotten by the writer that engineers advocate machining, not only so as to obtain the symmetry that is so desirable, especially in pieces to which motion is imparted, but also so as to make visible any hidden flaws that might be present in a forging. The importance of this objection is not to be minimized, but apart from the fact that a forging with the tough skin on and some hidden flaw left might be preferable to one from which the skin has been removed and the flaw "doctored up," it may be pointed out that in many cases simply polishing—say, for example, by means of the emery wheel—might effect the desired object without in any material degree weakening the strength of the surface protection. It can be imagined, at sight of these comparatively infusible envelopes, that it would be quite practicable to weld mild steel and obtain a fibrous product by piling and passing the heated mass through the rolls or working it under the hammer. Nevertheless, according to Mr. Skelton, some difficulty appears to have been encountered in the attempt to make rivet bars in this manner from mild steel plate cuttings, possibly not because of any inherent fault in the method, but because it may not have been carried out properly, as, for example, by the introduction of hard pieces in the piles. On the other hand, Mr. Ratliffe, of the Mersey Forge, it will be remembered, read a paper before this institute in 1879, wherein he explained how he actually preferred to roll down his ingots of mild steel into bars, which he afterwards piled to make into forgings. Not only did Mr. Ratliffe say that he obtained by that means a fibrous material, free from all crystalization, but also that he accomplished this desirable result at considerably less cost than by making the forgings from large ingots. It is not likely that this economy would follow in every case, but much would be gained if the results obtained by the process were to induce confidence and justify its adoption in cases of awkward forgings, which could be more easily formed by building up from bars than by hammering down from a large mass. In conclusion, it may be pointed out how the characteristic to which this paper refers—namely, the greater fusibility of the interior of a mild steel bar as compared with its exterior portion—will assist operations in the manufacture of the Mannesmann tubes. Without asserting that the phenomenon in question plays an important part in the process, it is certainly interesting to note that as the interior of the bar must be in a more pasty condition than the outside, being nearer its melting point, the circumstance, if not actually conducive to the production of a hollow center, will at any rate offer little opposition to the forces that induce its formation.

Standardizing Boiler Making Material.

At the last convention of the American Boiler Makers Association, standard specifications were adopted which should cover the use of all kinds of material entering into the construction of steam boilers, and the standard selected is sufficiently high for all practical purposes, and when lived up to will produce a boiler which will certainly be composed of excellent material. The next thing will be the enforcement of the use of such material as has been specified, and if the association has power to prevent unscrupulous makers from using tank iron, as has been done in some cases which have been noted, the results cannot help but be beneficial and will materially lessen the number of explosions. There is one thing yet to be done for governing the construction of boilers, and that is to make the reckless use of the drift pin a criminal offense, for it is well known to all persons who have had any familiarity with a boiler shop that often the drift pin is used to such an extent as to produce a strain almost to the point of rupture before the rivet has been put in place. At the present day it is no unusual sight to see workmen while constructing a boiler, insert the drift pin to bring two holes together and then drive it with small sledges until enough stretching has been produced in the iron to bring the holes sufficiently close to permit of the insertion of the rivet, and this is not called criminal practice, and yet the metal has been deprived by such usage of a large portion of its strength. This reduction is never taken into account when calculating the safe working pressure. Tank-iron and the drift pin are responsible for a large number of lives lost during each year, but criminal carelessness, or ignorance, which should be classed as criminal, is also responsible to a similar degree.—[Stationary Engineer.

New Russian Iron and Steel Works.

The Russian Government has granted a concession to the newly-formed Donetzki Co. for the establishment in proximity to the Konstantinowka Station of the Kursk, Charkow, and Azov Railway, of an iron and steel engineering works, with a view to exploiting the coal, iron, manganese and other deposits found in the district. The capital of the concern has been fixed at 1,500,000 metallic roubles.

LAKE SUPERIOR MINING NOTES.

The foreclosure sale of the properties of the Bessemer Consolidated Iron Co. took place at the Court House, last Monday, as advertised. The properties involved are the Iron King, Bonnie, Blue Jacket, First National and Valley—the old Burton properties. They were bid in at $50,000 by G. D. VanDyke of Milwaukee, attorney for W. W. Wight, the new trustee for the American Loan & Trust Co. It has been sincerely hoped that the tangle of litigation in which these properties have become involved would shortly be straightened out; and much encouragement was given by the purchasers at Monday's sale that there would now be little further delay in the opening up and active operating of most of them. On the other hand, however, the parties interested on the other side—or one of the other sides—assert that this is only the beginning of the end, and that the end is not yet anywhere in sight. It is certainly unfortunate that these valuable properties should be thus tied up in such shape that little benefit is being derived from them by anybody.—[Pick and Axe, Bessemer.

The new Badger mine, owned by the Commonwealth Mining Co., and discovered and opened up this year by Supt. O. C. Davidson, one of the ablest and most succesful mining men in the Lake Superior district, will easily produce and ship 70,000 tons of ore by the close of navigation next month, this being the amount sold by the company for this season's delivery. The Commonwealth folks have just sold 35,000 tons of Badger ore for all-rail shipment during the coming Winter, none of which, however, will be delivered until after the close of navigation some time in November. The output of the Badger during the first year of its existence as a mine is a remarkable one, the work achieved by the bustling and able young superintendent, having, with possibly one of two exceptions, never been equaled by another mine manager on this or any other range. The ore is a very high grade of non-Bessemer, and the deposit seems to be well nigh inexhaustible. The Badger indeed has a brilliant future before it, and as an ore producer bids fair to become a formidable rival of the giant Chapin within a few short years, and its product nearly equals the latter in excellence of quality.—[Florence Mining News.

Mr. Jas. Clancey and others who secured an option from the Iron Cliffs Co. to explore the northeast quarter of the northeast quarter of section 33, 47 27, and the northeast quarter of the northwest quarter of section 34, 47 26, have commenced operations in earnest. There was some work done here two years ago by a pool composed of Ishpeming people, who sunk a shaft thinking it was upon lands owned by Milwaukee and other parties, when in fact it was upon property of the Iron Cliffs Co. They found ore, some of which proved to be a Bessemer. Work was discontinued when they discovered upon whose lands they were operating. They have pumped out the old shaft and will do something in the way of further sinking and drifting. Those interested think they have a good prospect, and will push explorations vigorously.—[Iron Ore, Ishpeming.

If prospects at the Pioneer hold out as favorable as they are now, no doubt this property will be shipping its share of ore in the Spring. There is every reason to believe that at last have the management's labors been rewarded and something of importance has been developed. At No. 1 test pit, the drift to the east was begun last week and until now has been steadily working in almost clean ore. According to last accounts they had passed through 20 feet of ore and there were then no signs of the deposit giving out. The drift was started at a depth of 50 feet and has beed working night and day. No. 3 test pit, about 140 feet east of No. 1, at a depth of 25 feet is bottomed in ore, caved at the wrong time necessitating the sinking of another, consequently No. 3 was started with the above results. The Pioneer has been having a streak of poor luck since its beginning, but we are of the opinion that within a reasonable time we will see something more than fair prospects at the Pioneer.—[Ely Iron Home.

Shaft sinking was this week commenced at the Sheridan Exploration in 62-14. It is the management's intention to sink 100 feet and then crosscut north toward the foot wall. They are now sinking through the outcropping and some excellent ore is being placed on the stock pile. The developments at the east end also continue more encouraging as depth is obtained.—[Iron Journal, Tower, Minn.

The recent discoveries of ore on section 9, in town 46-29, are of considerable importance. In fact, it is one of the most important discoveries that has been made for two years, if the deposit shall prove to be extensive. The dip here is to the north of the pits where the ore was found. The diorite lies to the south of the ore pits. The ore taken out is perfectly clean, in fact, is of a very superior quality; assays taken from a fair sample have run so high as 68 per cent. in metallic iron and .015 in phosphorus. The ore is of the red and specular nature, and certainly resembles the Lake Superior red specular very closely. From the surface indications it would seem as if there was a large body of ore at this point. The land is owned by the Negaunee Mining Co., who are now putting in a drill to test the deposit. Capt. Sam Mitchell, of Negaunee, now has 15 men working on the east half of the southwest quarter of section 10 adjoining. Work was begun there last week. They have started a shaft on the trend of the formation east, and expect to find about 50 feet of surface. If the drill should discover a material deposits of ore at this new point (and we believe it will) it will open up a new and important field on the Marquette range. The new shaft is being sunk only 80 rods from the old Greenwood furnace.—[Lake Superior Democrat.

Messrs. Alfred Kidder and Thos. Witers, who have charge of the local affairs of the Lake Angeline mine, were inspecting the east end property on Wednesday, with a view to future operations. They have been awaiting the action of their neighbors, the Cleveland and Lake Superior Mining companies respecting the pumping out of the waters of the lake, but as nothing could be learned as to when this would be done, they have decided to go ahead independently of the others, as mentioned in these columns a few weeks ago, and will accordingly arrange for the removal of the water from the shallow arm of the lake that occupies land owned by them. They will construct a dam, the steam shovel being used to hasten the work, and expect to make a start in a few days.—[Iron Ore, Ishpeming.

IMPORTANT BOILER TESTS.

Mr. W. C. Temple, of Pittsburg, Pa., manager, writes *The Iron Trade Review* as follows, regarding some recent important tests of the Babcock & Wilcox Co.'s boilers: "Mr. Daniel Ashworth, the well known consulting and mechanical engineer of Pittsburgh, has just finished making a test for the Oliver Iron & Steel Co. of two Babcock & Wilcox boilers, which have been set over two puddling furnaces at the Oliver's Tenth Street Mill, Pittsburgh. We take pleasure in handing you a copy of this test which, we think, will be of great interest to a majority of your readers. In a series of tests recently made by Mr. Ashworth, at the Edgar Thompson Steel Works, the results obtained from the two-flue boilers, fired direct with a good grade of run-of-mine coal, were just about the same as those obtained from these Babcock & Wilcox boilers where slack coal containing a large percentage of dirt was used, and had done its work in the puddling furnace before the waste heats were delivered to the Babcock & Wilcox boilers."

The report is as follows:

"In compliance with your request I have made evaporative test of the two of 45 H. P. each, Babcock & Wilcox boilers, said boilers being placed above their respective puddling furnaces, so that the steam generated therein is from the waste heat after doing the work in furnace for puddling, or in other words, that which usually passes out of the stack.

DIMENSIONS OF BOILERS.

Type of boiler	Babcock & Wilcox Water Tube.
Rated horse-power	(45 each).
Heating surface	1,026 sq. ft., or 513 sq ft. each.
Grate surface of puddling furnace	19.83 sq. ft., or 9.916 each.
Stacks	One 42 in. x 36 ft., and one 42 in. x 37 ft.
Vertical distance between bottom of stack and grate bars	15 ft.
Total height from grate bars to top of stack	52 ft.
Ratio of heating surface to grate surface	51 to 1.

RESULTS.

Duration of test	8 hours.
Kind of coal	bituminous slack.
Coal consumed	4,869 lbs.
Water evaporated	26,864 "
Coal per hour	609.7 "
Coal per hour per sq. ft. of grate surface	30.7 "
Water per hour	3,358 "
Water per hour per sq. ft. of heating surface	3.37 "
Boiler pressure	102 "
Temperature of feed water	150 deg.

RESULTS.

Temperature of escaping gases	493 deg.
Draft suction	.3 in.
Water per lb. of coal	5.6 lbs.
Water per lb. of coal from and at 212 deg	5.9 "

HORSE-POWER.

Rated horse-power	45 each or 90
Horse-power by observed evaporation	55.9 each or 111.9
Horse-power from and at 212 deg	60.6 each or 121.3
Horse-power, Centennial standard	55.6 each or 111.3

"Showing a gain of 10 per cent, by heating feed water to 102 deg. over what it would have been had the temperature been 60 deg., or the practice of feeding cold water.

"It will be observed that the development of capacity is beyond the rating (45 each), it being from and at 212 deg., 60.67 H. P., 33 per cent. above. Centennial standard equals 30 lbs. of water evaporated from 100 deg. temperature, and 70 lbs. steam pressure equals 55.69 H. P., an advance over this standard of 24 per cent. above rating.

"The evaporation to coal, while seemingly no object, as the fuel has done its work in puddling, clearly shows that the efficiency is close to the ordinary results of two-flue practice without undue urging. With this work as a net gain in fuel, there is still remaining an opportunity for improvement: viz., the utilization of more of the heated gases as temperature of escaping gases is still too high. An increase of heating surface by more boiler would do this. I think this is a step in the right direction and the results favorable. A number of these in operation would form an excellent auxiliary to the main battery. The results would be more uniform also in a number operating.

"The operation of the steam jets was such that the upper furnace received all the condensation and wet steam, a fault greatly due to piping of same. I would pipe each furnace from its own side or source, as now the upper acts as a syphon drawing the water in. The carrying of water in this class of boiler should not be permitted higher than second cock unless for special reasons, such as stopping of water supply, etc. A proper attention to this will greatly add to the efficiency and give drier steam, which is important."

Oil in Boilers.

It goes without question that oils of certain kinds, when they get into a boiler, are capable of causing great injury, while oils of other kinds are frequently introduced in large quantities and good results are claimed from such usage. Whether oil will produce injury to a boiler depends altogether on its nature, as some oils are so light as to be readily vaporized by the heat, while others being more dense and having a glutinous nature, combined with sediment, scale and other foreign matter, producing a dense mass of low heat-conductivity which will settle to the bottom of the boiler, preventing contact of the water therewith, which will soon result in the formation of a blister on the sheet. This is particularly the case in tubular boilers, and to a large extent in boilers of the crown sheet type. In view of these facts it is considered good engineering to keep all oils of an animal or vegetable nature as far from the interior of the boiler as possible, but as no such injurious effects have been reported from the use of mineral oils, these do not seem to be so objectionable, for good results have often been obtained in the way of preventing the adherence of scale by the introduction of mineral oils into the boiler. —[Stationary Engineer.

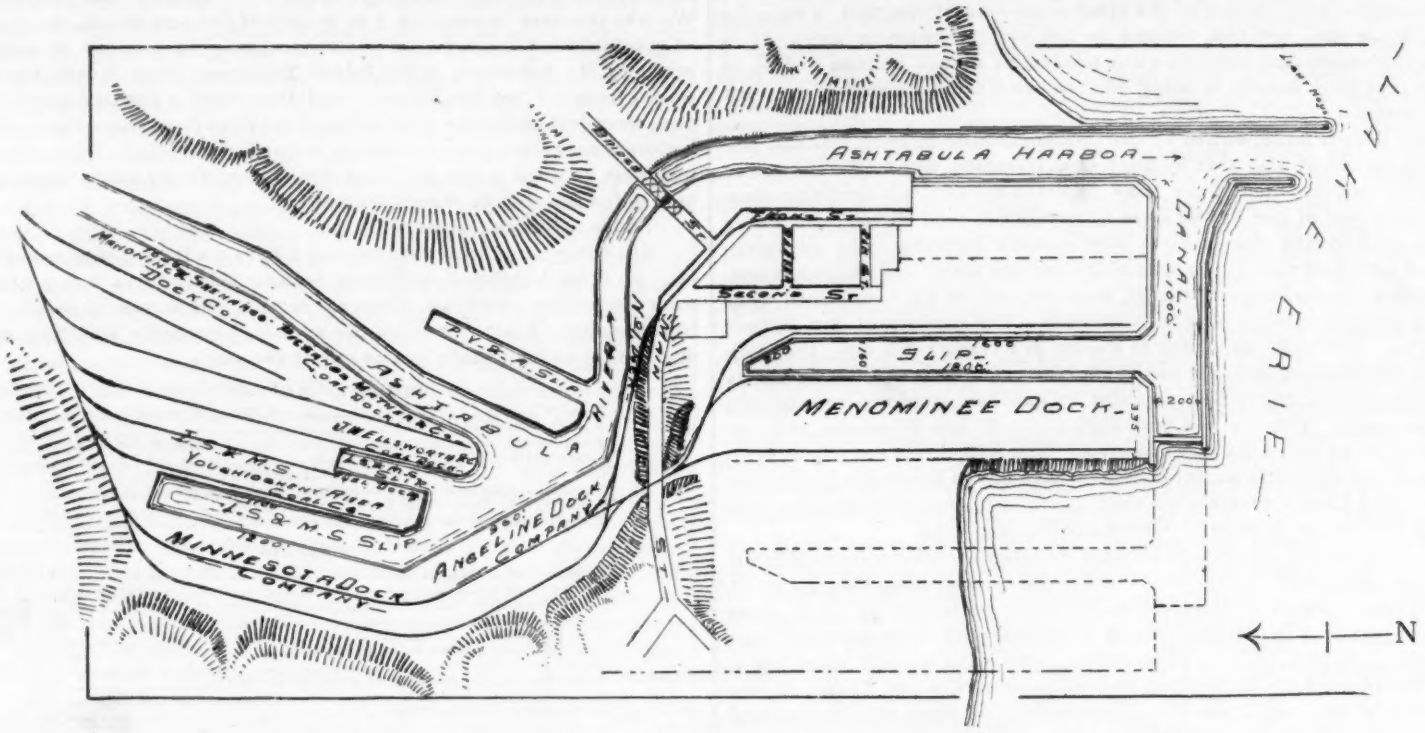
DOCK IMPROVEMENTS AT ASHTABULA HARBOR.

Within a few days past the Lake Shore & Michigan Southern Railway Co. began receiving iron ore on its new lake front docks at Ashtabula Harbor, O, a small terminal point a few miles east of Cleveland that has a record of receiving and shipping to iron furnaces more ore than any port in this country. The building of these docks is an important departure in the business of handling ore on the lakes, inasmuch as the railway company, finding itself unable to increase its facilities for handling ore and coal in the harbor, has been compelled to go out into the lake and construct a breakwater, making land and canals within the enclosure for the accommodation of the increasing traffic. Just 1,800 feet front of the new docks has been completed, in a work that contemplates an addition of 8,300 feet front to the company's present docks. Before going into detail regarding the new enterprise, however, it may be well to note the increase in the ore business at Ashtabula. There are two railway companies controlling the docks, the Pennsylvania Co. on the east side of the river, and Lake Shore on the west. The building of these docks will place the Lake Shore company far in the lead of all competitors in the trade on Lake Erie, and the following table will prove interesting in showing the Lake Shore's proportion of the business during the several years past:

Year.	Total receipts, Ashtabula, gross tons.	Receipts, Lake Shore Co., Ashtabula, gross tons.	Lake Shore per centage of entire business.
1883	670,000	293,669	43.8
1884	650,000	239,243	36.8
188	582,000	168,780	29.0
1886	672,000	253,624	37.5
1887	1,103,839	528,936	47.9
1888	1,288,530	594,300	45.3
1889	1,963,490	1,039,920	52.9
1890	2,176,730	1,177,620	54.1

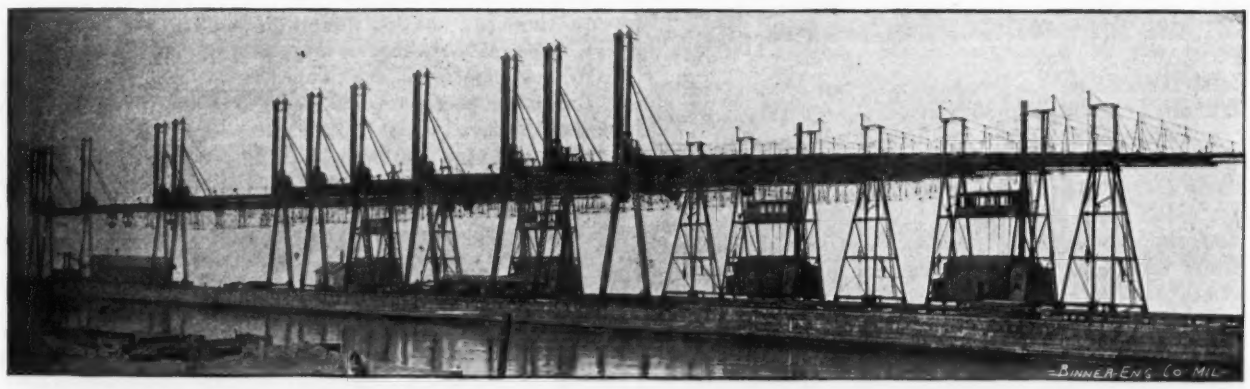
Ore was received at Ashtabula Harbor by the Pennsylvania Co. as early as July, 1873, but the foregoing will serve to show the increase in business during the most important period, the past four or five years, within which time the lake business in most branches has been doubled, and even trebled in some cases. The Lake Shore company's receipts of ore at Ashtabula began with the season of 1875. During that year only 15,000 tons were received and the aggregate for any one year did not reach 100,000 tons until 1880.

The present dock frontage in Ashtabula, irrespective of the new lake front improvements undertaken by the Lake Shore company, is 10,200 feet for coal and ore, 5,200 feet of which is on the Lake Shore or east side of the river and 5,000 feet on the Pennsylvania or west side. The accompanying drawing shows only the Lake Shore side, but includes the plan of breakwater and slips on the Lake front. Of the 5,200 feet of dock front on the Lake Shore side within the harbor, 4,000 feet is used for ore, so that that proportion of the lake front docks already completed, 1,800 feet, brings the total frontage for ore up to 5,800 feet, or an increase in capacity of 45 per cent. The new docks under way will add 4,700 feet front, or 117 per cent., to the capacity within the harbor, and if the plans of the proposed east slip is carried out the total of outside dock will be 8,300 feet front, or more than double the entire frontage in ore within the harbor. Work on that portion of the 4,700 feet of dock not equipped for service this Fall will be pushed to completion during the Fall and Winter, although the construction of the proposed second slip to the east of the present workings may be delayed to await a further demand for dock space from iron ore interests. When this work was planned, a little more than a year ago, the demand for dock space was very urgent, on account of a boom in the ore trade. Conditions have since changed materially, as has been shown by the restriction in the present season's output from Lake Superior, but there is every indication of another active season in 1892, and it is confidently expected that the demand for ore before another season comes around will warrant the construction of this second slip.



L. S. & M. S. RY. DOCKS, ASHTABULA HARBOR, O.—NEW LAKE FRONT IMPROVEMENTS.

Some idea of the amount of material and the expense attending the construction of these docks can be formed from a statement of material used in the work so far. In the construction of the breakwater and docks, there was put down 127 cribs, 40x24 feet and from 8 to 22 feet in depth, with an average depth of 16 feet. Four thousand cords of limestone, 225 tons of iron drift bolts and spikes and 7,500,000 feet of timber have gone into the work. Of the timber, about 4,000,000 feet was pine, 3,000,000 feet hemlock and 500,000 feet oak and elm. Rock dredging amounted to 100,000 cubic yards and earth dredging 250,000 cubic yards, in addition to the very large amount of filling necessary in construction of this nature. The work was started on July 20, 1890, and the first crib was sunk August 6, 1890. It was necessary to push operations while in the open lake, and in the four months intervening between August 1 and December 1, 73 cribs were sunk. The additional cribs were sunk at irregular intervals from that time on, but the work was not pushed as it had been at the outset. A. V. Powell, of Chicago, is the engineer in charge, the work being a special commission with him. Mr. Powell makes a specialty of dock construction. He built and equipped E. L. Hedstrom's big coal dock in Chicago, and the ore docks at South Chicago, and had charge of the Calumet & Chicago Dock Co.'s operations before coming here.



BROWN HOISTING AND CONVEYING PLANT, LAKE FRONT DOCKS, ASHTABULA HARBOR, O.

In a second engraving accompanying this article is presented a view of the ore handling equipment of that portion of the new docks already completed. The equipment consists of twelve hoists of the Brown pattern, suitable for unloading two of the largest ore carrying steamers at one time, working six hatches on each vessel. It is with such plants as these that vessels carrying

2,000 to 2,800 gross tons of ore and given special despatch are enabled to leave port in most cases nine to twelve hours after arriving. Mr. H. T. Raser is in charge of the new docks, and Mr. John P. Manning has general supervision of the Lake Shore company's affairs at Ashtabula.—[Marine Review.

Water-Tube Boilers on Board Ships

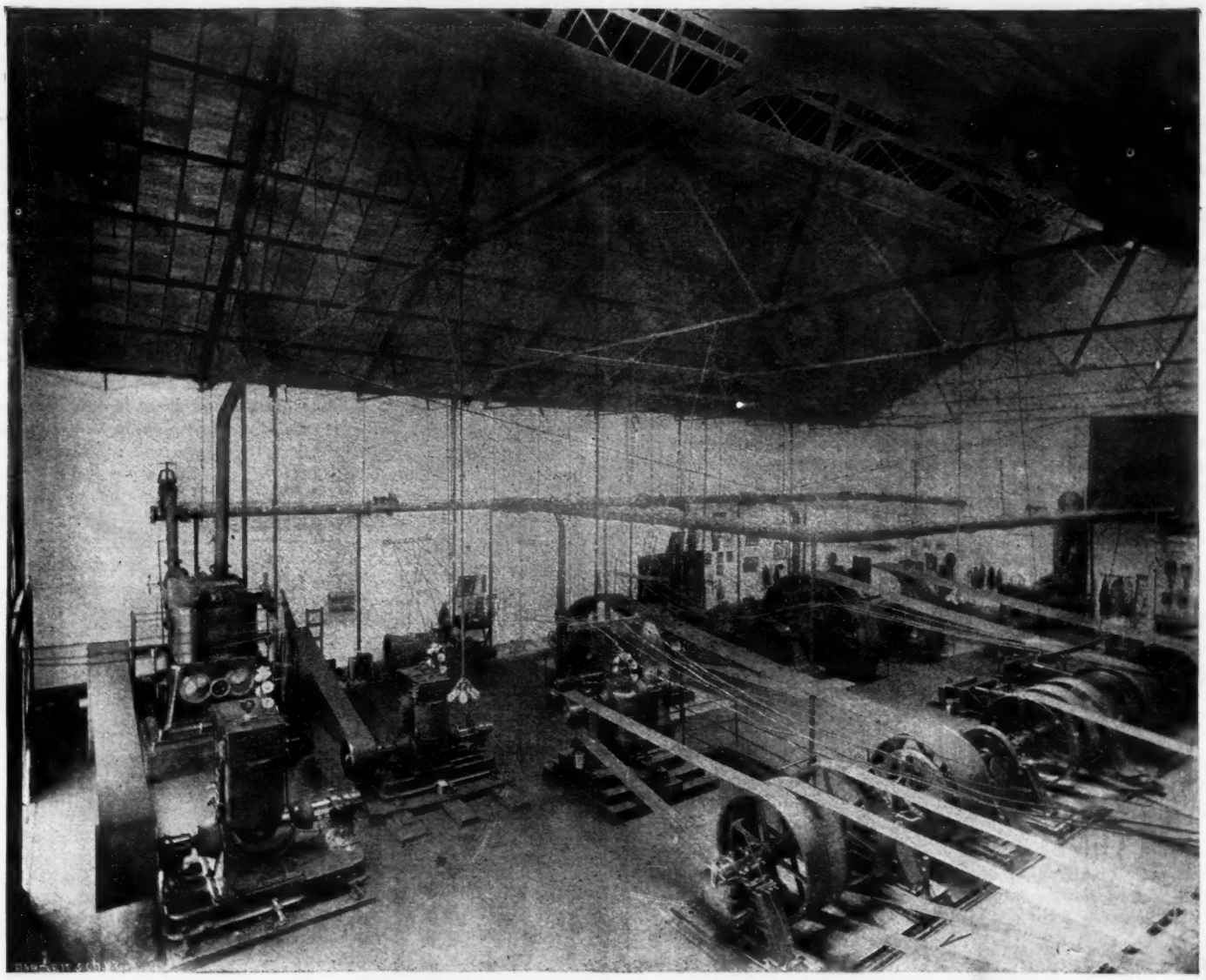
The American Government have decided to introduce the water-tube boiler into their warships, and the results will be watched with the closest interest by marine engineers generally. The decision has not been arrived at without careful consideration and exhaustive tests as to the efficiency of this type of boiler. The tests made with a Ward boiler showed that it consumed 55 lbs. per square foot of firegrate per hour, whereas with ordinary marine boilers in high-speed steamers the consumption is 25 lbs.; in locomotives, 70 lbs, but with 6 inches of forced draught, 138 lbs. have been burned in the yacht. The evaporation of the Ward boiler was, it is stated, 10 lbs. per square foot of heating surface per hour, while in fast steamers it is 7 lbs. to 8 lbs. The advantage is in raising the steam rapidly and in having light boilers, the weight of a boiler for 850 I. H. P. being only 14 tons. It is significant that the Americans do not intend to depend entirely on the tubular boiler for their steam, and that they are only fitting it to a coast defense ironclad named Monterey. She will have two ordinary "Scotch" boilers, which will give her steam for ten knots speed—and this can be increased in half an hour to 16 knots by lighting and working the tubular or coil boiler, or, if the vessel be at anchor, and it is desired to start soon, she can be under way at 15 knots for half an hour after lighting the fire. Many torpedo boats have been fitted with tubular boilers, and a British cruiser of small displacement is, we understand, to have the Thornycroft boiler.—[Glasgow Engineer.

The Hardware Trade.

Reports from the hardware centers indicate that the trade has been fairly active and the transactions in the aggregate heavy, and also that the situation is improving. But, as we have already observed, the early "great expectations," which were founded on big crops assured and high prices in promise, have not been fully realized, hence many are disappointed and dissatisfied, although, really, there is nothing of which to complain, except low and somewhat irregular prices. Fortunately for the country, there is no general disposition to create a boom. The long depression in agriculture induces conservatism in the industry. Farmers are disposed to use this season's surplus to make good past losses, to settle for old purchases rather than to make new, and this disposition on their part should be a warning to manufacturers against overproduction for next season. There is a good demand for everything required at this season of the year, and the trade is in a healthy and vigorous condition.—Farm Implement News.

AN ELECTRIC STREET RAILWAY PLANT.

Recognizing the necessity of a perfectly reliable source of power, the Federal Street & Pleasant Valley Electric Street Railway Co., of Allegheny and Pittsburgh, Pa., has spared no expense in fitting their power house with the best of steam and electric machinery. The building is absolutely fire-proof, with brick walls and tile roofing. The boilers are of the Hazleton type, rated at 1,000 H. P. in two units, and each furnished with three independent Roney stokers. Four lines of railway are operated by the company, and the current is furnished by: Five 80-watt Edison dynamos; one 150-watt Edison dynamo, and three 40-watt Thomson-Houston dynamos. In practice these two differently wound generators are not found to work well together, and in a short time the electric machinery will probably be exclusively Edison. The power originally consisted of: One 18x33 and two 24x33 Buckeye engines, and with a view to guarding against possible delay through accident, a system of clutches and countershafting was adopted and so arranged that any engine might run any dynamo, or even take all the load. In spite of these precautions, they have had more than their share of trouble. That they have been so unsuccessful in this respect has been the fault of the design of the plant, rather than carelessness in its operation or the policy of the purchasing agent. Belts and clutches always seemed to slip when the load was heaviest, and the shaft bearings got hot when greater service was demanded and when a shutdown was most vexatious. Finally, losing all patience, the company have installed an 18 and 30x16 Westinghouse high-duty compound engine, belted direct to a 150-watt Edison dynamo, and intend to thoroughly test the combination by comparison. Its success seems to be already demonstrated to be as great as the failure of the system whose work it shares. It is quite probable that independent engines will eventually displace the centralized power with its expensive complication of shafting, clutches, belting, etc. An interior view of the station, from a photograph, shows the disposition of the machinery and the contrast between the simplicity of the one plant and the intricate construction of the other.



AN ELECTRIC STREET RAILWAY PLANT.

Transmission of Electricity for Power.

A contract has just been concluded between the Niagara Power Co. and the Cataract Electric Co., of Buffalo, by which the Buffalo company acquires the exclusive right to the use of all electricity generated at the new tunnel so far as Buffalo is concerned. The new company will receive the electricity at the city line and distribute it to consumers in the shape of power. Its officers hope to be able to supply at least 20,000 horse-power before November 1, 1892, and at such rates as to supplant steam power now in use to that extent. The question of transmission has been practically solved in Germany, where a current of 300 horse-power has been carried on a single wire for a distance of 118 miles and delivered without material loss and with perfect safety.

STEAM USERS Should Read this.
Increase the Capacity of your Boilers.
Scale is a Non-conductor of Heat.

SAVE YOUR FUEL AND PROTECT YOUR BOILERS FROM SCALE AND GALVANIC ACTION OF WATERS. WATERS ANALYZED FREE AND THE COMPOUNDS MADE TO SUIT EACH WATER.

INTERNATIONAL BOILER SOLVENT.
(PURELY VEGETABLE.)

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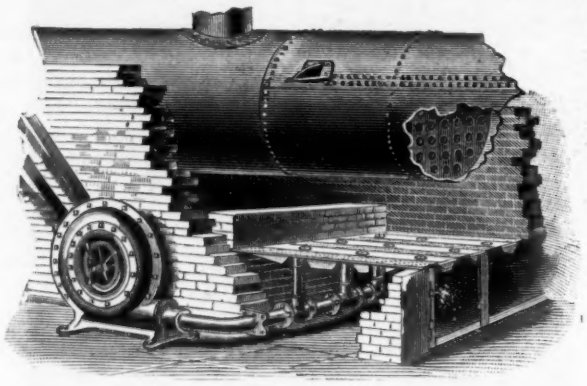
Ohio Office, Canton, O. ROBERT H. CREVOISE, Agent.
WRITE FOR INFORMATION AND PRICES. BEWARE OF INFRINGEMENTS.
CHICAGO, ILL.

THE GORDON HOLLOW BLAST GRATE.

We here illustrate the Gordon patent hollow blast grate and apparatus, manufactured and sold by the Gordon Hollow Blast Grate Co., of Greenville, Mich. The blast grate itself is a hollow cast section with suitable blast openings in its upper surface for the escape of compressed air to fan the furnace fires. These blast openings, called valves, are about seven inches in diameter, and are so designed that, though the compressed air may readily escape through them, the ashes and fine particles of fuel cannot drop through into the hollow space beneath. Each blast grate is supplied with from three to five of these valves, according to the length of the grate. The grates are uniformly eight inches wide by four to six feet long. Each valve is to all intents and purposes a "Tuyer iron" or "Duck's nest," such as is found in every blacksmith's forge, and the fire underneath a single boiler, fitted with these grates, will be quickened as though a dozen muscular blacksmiths were "pumping" with might and main upon a like number of bellows, whose blast outlets were distributed about at regular intervals throughout the furnace. In this case, however, a fan or blower of suitable capacity supplies the place of the bellows, while the muscular arm of the blacksmith is supplanted by the steam engine. As will be seen, the main blast pipe penetrates the side wall of the furnace at the floor line, extending thence across the ash pit under the back end of the grates. As the blast pipe is at times subjected to considerable heat, it is of cast iron, with heavy flanged joints accurately fitted to make it air tight. From this pipe 4-inch vertical connections are made with the blast grates above. When in position for use this main blast pipe lies on



the floor of the ash pit, well back against the wall supporting the back end of the grates. It is thus quite out of the way of the fireman when cleaning out underneath. The cast pipe usually terminates at the outer line of the furnace wall. Here a blast gate is attached, which, as it is opened or closed at will, gives the fireman absolute control of the blast and consequently of the fire. Light galvanized iron or tin pipe is employed to make the blast connection between the outer, or gate end, and the blower. As will be seen, the apparatus, which is simplicity itself, consists of blast grates, blast pipe and blower. As from 200 to 400 cubic feet of air is forced through each blast grate per minute, it is sufficiently protected from injury by heat, consequently the claim that barring accident, the hollow blast grate will last for a lifetime, seems plausible.

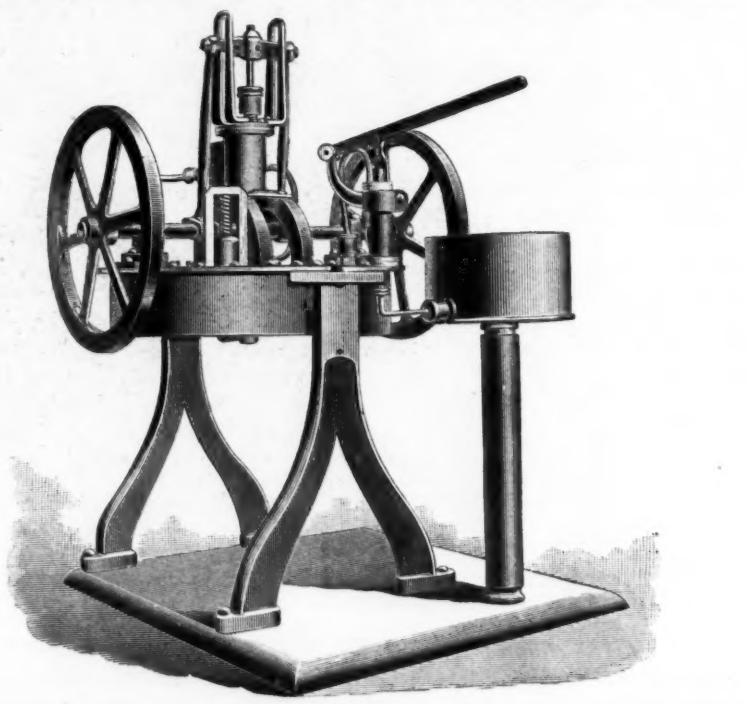
The hollow blast grate is the invention of Elonzo J Gordon, of Greenville, Mich., who may be said to have had life-long experience as fireman, engineer and mill owner and operator. The problem Mr. Gordon set out to solve was this: A simple and durable contrivance that shall insure the quick combustion of such fuels as, with the ordinary draft, burn so slowly as to be practically worthless for steaming purposes. Prominent among these may be named culm and screenings from coal, baggosse from sugar cane, the waste from cotton seed, fine dust from the band saw, spent tan bark, together with the dust and mill waste from such slow burning woods as hemlock, cypress, gum, elm, oak, basswood, redwood, cottonwood, etc., etc. Mr. Gordon claims he has successfully solved this problem, and his company proudly boast that they have yet to learn what failure means. Though the blast grates have now been in constant use for upward of two years, we are informed they have not in a single instance failed to secure the hearty endorsement and approval of the users. And what is more, though they have been subjected to practical tests in nearly every State in the Union, and under all sorts of conditions, not one has needed repair, not one has shown the slightest evidence of warping or sagging, not one has failed to perform the work set for it, in a manner highly satisfactory to the user. Their proposal with guarantee tends to inspire confidence. Reduced to its simplest terms it is this: "If you will give the blast grates a trial, we guarantee you shall be so well pleased with their work, that you will accept and pay for them at the expiration of the trial period."

When using the hollow blast grates the fires are fed exactly as when using grates of the ordinary pattern, by carrier, or through the open doors, with dust, spalts, slabs, blocks, or other coarse and heavy fuel. It is further claimed for these grates "that they increase four-fold the life of the common grates used in conjunction with them." This claim is based upon the theory that as the blast grates do all the work, the intermediate grates are practically relieved from duty, and as a consequence do not get heated sufficiently to "burn out."

A recent visit to the works of the Gordon Hollow Blast Grate Co., at Greenville, Mich., by an *Iron Trade Review* representative, showed that the company was rushed with orders, and that the business was developing to their entire satisfaction. The officers of the company are: R F. Sprague, President; E. J. Gordon, Vice President; T. J. Potter, Secretary and Treasurer.

A NOVEL AND ECONOMICAL ENGINE.

The engine illustrated in connection herewith was recently invented and patented by Mr. Mathias J Hinden, of Cleveland, O. The inventor claims that in his construction he is enabled to "raise steam" quicker than in any other engine that is designed to be steam-driven; that he saves three-quarters of the space usually taken up by boilers; that there is no possible danger arising from explosions, as steam is only formed as it is required for use; that it



is exceedingly simple and cheap in point of construction, and that no steam escapes from the exhaust into the atmosphere, as it is entirely converted into hydrogen gas and consumed. In the smaller class of engines the inventor proposes to utilize gasoline as the heating agent, and he contends that his improved device can be advantageously employed in propelling street cars, launches, etc, he having already demonstrated great power in an engine having but seven-eighths of an inch stroke, as per accompanying cut, it having worked satisfactorily in all respects.

The Aerated Fuel Company.

We have received the following from the Aerated Fuel Co., Springfield, Mass.: "We have begun suits in the United Stated Circuit Court for the District of New Jersey, against a firm of manufacturers in that State for making and selling apparatus infringing our patents, and against two glass manufacturing companies for using such apparatus. We claim that our patents cover the whole system of burning oil with compressed air, automatically regulated, and we are prepared to bring suits against any one else infringing these patents. Please take notice of this fact, and beware of any one offering you any oil burner to be used with compressed air, in infringement of our rights. W. S Collins, 45 and 46 Drexel Building, New York, is the sole licensee for our system in Southern New York State, Eastern Pennsylvania and the States of New Jersey, Delaware, Maryland and the District of Columbia, and we have representatives for all other sections of the United States and Canada, authorized to put in our system, with guarantee of its successful working."

THE HACKNEY HAMMER CO.
OF CLEVELAND, OHIO,
MANUFACTURE THE MOST SUCCESSFUL
POWER HAMMER
THAT HAS YET BEEN OFFERED TO THE TRADE,
THOROUGHLY PRACTICALLY TESTED FOR TWO YEARS
BEFORE BEING PUT ON THE MARKET.
NOW ENDORSED BY SOME OF
THE BEST FIRMS IN THE COUNTRY.
WRITE FOR CATALOGUE AND ALL INFORMATION.

STEEL vs. IRON.

It is the general impression in trade circles that the quality of the manufactured iron now made is improving. Consumers are more exacting in their requirements, the practice of testing has grown quite general, and greater intelligence now prevails among all classes of manufacturers. More attention is paid to the scientific portion of the business. Chemical formulas are no longer regarded with contempt. Raw materials are purchased with some discrimination, the effects of different fuels are carefully noted, and rule-of-thumb has to a great extent given way to the application of exact knowledge. The gradual disappearance of old iron rails from rolling mill stock piles is also a matter of no small consideration in this question. As long as they were plentiful and cheap there was a constant temptation to use them, as their conversion into other forms of iron was so easy and comparatively so inexpensive. The passing away of the old rail era together with the growth of scientific knowledge relative to iron making could not fail to effect a marked improvement.

This improvement has been especially noticeable in the manufacture of bar iron in the West. For example, common bar iron of Western make is no longer the despised article that it was but a few years since. At that time a storm of indignation was evoked when the charge was made that a Chicago fire escape manufacturer was using common bar iron in building structures upon whose strength many lives might depend. The common bar iron now made easily meets the requirements of agricultural implement manufacturers, and has further been known to endure the exacting tests of the most rigid railroad inspectors.

Notwithstanding this array of argument, apparently proving that the quality of the iron now made is better than ever, it is the opinion of experts that the limit of improvement has been reached, unless consumers are willing to pay greatly enhanced prices. Further improvement in quality is to be gained by reworking, thus making the product more homogeneous, but decidedly more expensive. In this event, however, the consumer naturally turns to steel, which will meet his requirements at a less price. The quality of steel is shown to be steadily improving, and, unlike iron, it has a free field which it will enjoy until some other metal or alloy is found possessing greater merits and is available at a reasonable price. The improvement in the quality of the steel made in the past five years is very remarkable. No longer are complaints made of the mysterious cracking of steel plates, but steam boilers are now almost universally made of steel and iron ships have completely given way to steel ones. The manufacture of reliable steel plates is no longer confined to one or two works in this country, in which the process almost seemed to be a trade secret, but there are upwards of a dozen of them, all ready to meet the most severe specifications, which would be impossible of execution in iron except at very much higher cost.

In other branches of the steel trade the number of manufacturers is constantly increasing, and the excellence of their product is a matter of wide comment. Who can make good thin steel sheets? was once a live question, but it has now almost changed into, who cannot make good thin steel sheets? In heavy forgings iron and steel have for some time been struggling for the mastery, and each has its advocates. The iron manufacturers say that they find the quality of the scrap now in the market is so irregular that they can no longer depend upon it, and they will only guarantee their work when made from reworked muck bar, which is necessarily expensive, and the result is that they are themselves turning to the use of steel. In fact, the inference seems to be unavoidable that steel is making greater headway than ever in all branches of trade in which reliability and excellence of quality are sought.—[Iron and Steel Trades Journal, London.

DULLNESS IN CONTINENTAL IRON MARKETS.

The hopeful prospects which a month ago cheered the iron manufacturers of the Continent have changed, and there is nothing now to be seen, at least in the near view, but gloomy objects and depressing signs of inanition. The spurt in the French markets has run itself out. True, business has not yet fallen into the state of languor which we see in the neighboring countries, but there is nothing that can be described as activity, and the tendency is distinctly downward. In Belgium business is slacker than ever, the declining prices of pig iron having the effect of keeping consumers of the finished product out of the market in the hope of obtaining still easier terms later on. German affairs have changed but little during the last week, but the downward tendency of prices has become more distinctly marked. The retrograde movement in the English markets has weakened the tone of Continental trade generally.

Business in pig iron has further fallen off in the Rhenish-Westphalian markets. Coal of the industrial sorts and blast furnace coke continue to decline slowly in price, so that buyers of crude iron are disposed to wait. There

CENTRAL THOMSON-HOUSTON COMPANY,
48 ARCADE, CLEVELAND, O.
S. D. NESMITH, - - - - - Manager.
Motors from 1-12 h. p. to 100 h. p.
ELECTRIC LIGHT PLANTS INSTALLED,
Arc and Incandescent, Direct and Alternating,
ELECTRIC FANS!
FANS FOR VENTILATING!
ELECTRIC SUPPLIES.

are but few inquiries, and the offers made in response are often considerably below the official price lists. In Upper Silesia business is equally slack, and the tone of affairs is weak. Belgian iron is lower in price this week.

The demand for finished iron and steel of all classes is now very slack in the markets of the west of Germany. Buyers hold aloof, believing that cheaper coal must give them easier terms later. The expectation is justified by the downward course of prices. At Dusseldorf, bars and joists may be bought fully 5s. a ton below the prices officially marked. Manufacturers are forcing joists on the market, so that prices for that class of goods are especially weak. The export trade is very slack. Buyers in the Belgian markets show more reluctance to deal. The drop in the prices of coke and of pig iron has opened up a prospect of easier terms for finished iron and steel. Foreign customers are now buying but sparingly. A few small orders for plates have been received during the last week. The Paris market is less active, and reports of a failing demand have come to hand from the provinces. The proposed combination of the manufacturers of the North, East and center seems likely to fall through. Hence the besitation on the part of buyers.—[Colliery Guardian.

INCREASING USES OF SEAMLESS STEEL TUBES.

Few of the newer industries which have sprung up in the busy hardware district of which Birmingham is the centre have—to use an American term—more distinctly "caught on" than the manufacture of seamless steel tubes. The rapidity and success which have attended the production of this comparatively new article of manufatcure were due primarily to the requirements of the cycle trade. In a first-class cycle of whatever description a combination of great strength and extreme lightness is a prime necessity, and for such a purpose the ordinary lapwelded steel tube of whatever quality, was, in comparison with the seamless tube, quite "out of the running." This use of the seamless tube, however, important as it is to cyclists and cycle makers, is of little moment when compared to its adaption to hydraulic machinery, tubular boilers, and other purposes which affect not merely the convenience and comfort of individuals, but the safety and security of human lives from those terrible disasters which too often result from the breakdown of defective tubes under the strain of enormous pressure. Now, granted that the quality of the steel be good, a seamless tube made of that metal ought to possess Titanic powers of endurance under hydraulic or any similar strain. It has indeed, within the last few months, been undoubtedly proved that a ¾ inch tube, with a core of ⅓ inch, can be drawn in steel, on the seamless principle, capable of withstanding a pressure of 1,000 pounds to the square inch. The makers of boilers have not been slow to recognzie the superiority of these seamless steel tubes over copper tubing. The "life" of the steel tube is quite as long, the cost is considerably less, and under all circumstances it is more reliable than the copper tube hitherto in use. The production of tubes of seamless steel has already become an important branch of Birmingham industry, and another establishment of large dimensions and fitted with the newest and most approved machinery will very soon be added to those already in operation. There can be no doubt that for this industry there is a great future. When efficiency and economy can be combined in any article, with greater security for human life and limb, its success is assured. Commercial economy and humanitarianism are powerful forces in themselves, but when united they are, or ought to be, irresistible.—[Colliery Guardian, London.

Big Iron and Steel Contracts from China.

The destination of the iron and steel contracts which will be necessitated in the construction of the railway system now being gradually entered on in China is exciting a great deal of interest among Continental metallurgists. A short time back it was stated on the Paris Bourse that a syndicate of French capitalists had secured a concession amounting to several millions sterling for the building of a line from Pekin, and later on this was contradicted in favor of the statement that the German firm of Krupp had obtained an enormous contract for railway material. The truth appears to be that the Imperial authorities are anxious, as far as possible, to use only native iron and steel upon the work, and at the present time enormous steel works are in course of construction with plant supplied from the North of England, and under British management. The French Embassy at Pekin has represented to the Chinese authorities that these latter are bound by treaty to place contracts for railway material in France; but this view is so far from being accepted that a contract has just been put up for tender, and obtained by an English firm. The order was for only 2,000 tons of rails and sleepers, and the Continental firms tendered at higher prices than they would have done for a larger tonnage. However, since the placing of the contract in England, the amount has been increased from 2,000 to 12,000 tons.—[Iron & Steel Trades Journal.

INDUSTRIAL SUMMARY.

New Enterprises:—

The Eagle Rolling Mill Co., of New Ulm, Minn., capitalized at $300,000, have filed articles of incorporation.

Brightman & Collins, of Cleveland, will erect a machine shop, to be 58x103 feet, two stories, and built of brick.

The Williams Engine Co. has been incorporated, with a capital stock of $50,000, to build the Williams engine at Baltimore, Md.

The Lewis Valve Co., East St. Louis, has been incorporated; capital, $600,000; incorporators, W. J. Lewis, L. B. Fish and E. S. Marshall.

The Superior Land Roller Co. has purchased land at Gouverneur, N. Y., where it will erect a building for the manufacture of its goods.

The Prescott Steam Heating Co., of Chicago, with a capital of $150,000, has been incorported by C. C. Poole, A. H. Graves and G. A. Prescott.

The Continental Bolt & Iron Works, of Chicago, has been incorporated by A. Egerton Adams, F. M. Steele and D. P. Donelson, with a capital stock of of $60,000.

The Paragon Manufacturing Co. has been incorporated at New Haven, Conn., with a capital stock of $16,000. The company will manufacture hardware tools and specialties.

The Haish Manufacturing Co., of DeKalb, has been incorporated to manufacture fence wire; capital, $100,000; incorporators, Jacob Haish, Charles H. Salisbury and S. P. Bradshaw.

Plans have been prepared at Detroit, Mich., for a foundry and machine shop for the Brush estate, W. G. Thompson, trustee, to be of brick, 41x91 feet, three stories, and to cost $8,000.

The Cookshire Machine Works Co., at Cookshire, Que., has been incorporated, with a capital stock of $30,000, for the purpose of manufacturing machinery, foundry appliances, etc.

The Arthur Radiator Manufacturing Co. has been incorporated at Arthur, Tenn., by W. Arthur, J. S. B. Key, A. Findley and others to manufacture the Holland steam and hot water radiator.

Messrs. L. M Rumsey, C. D. McClure and Paul A. Fusz have incorporated the Madison Railway Equipment Co., of Madison, Ill., with a capital stock of $100,000. The company will deal in railway supplies.

The Courtwright Manufacturing Co., of Detroit, Mich., manufacturer of railroad hand-cars and other supplies, will soon remove its works to Benton Harbor, where land has been purchased for new works.

The Elizabeth Manufacturing Co., of Elizabeth, N. J., has been organized to manufacture electrical and mechanical apparatus at Elizabeth and Plainfield. The capital is $100,000. Asa D. Phillips may be addressed.

The American Engineering Co., of Jersey City, N. J., capitalized at $1,000,000, have been incorporated. The object of the concern is the construction of steam and electric power plants and the manufacture of machinery.

The Steele Signal Co, of Chicago, has been incorporated, with capital stock of $1,000,000, for the manufacture and sale of railway signal appliances and other mechanical devices. The principal stockholders are James W. Steele and Wm. F. White.

The Milner Lock & Manufacturing Co. has been incorporated at Denver, with a capital of $10,000. The incorporators are W. S. Wood, B. D. Allen, W. H. Bolthoff and Joseph Milner. The object of the company is to manufacture a tumbler lock for the hardware trade.

The Sewell Steel Heddle Co., capital stock $250,000, has been organized at Portland, Me., for the purpose of making machinery for manufacturing heddles and other machinery. The officers are: President, George W. Martin, of Lowell, Mass.; Treasurer, Samuel Sewell, of Lowell, Mass.

The Damascus Steel Co., of Denver, Col., has been formed for the manufacture of steel and steel tools under certain patents. The capital stock is placed at $1,000,000. S. P. Rose, G. Z. Dimmitt, C. G. Hathaway, T. J. Cooper, J. S. Mosby, Jr., and L. D. York are the directors of the company.

Grant Machine Tool Works, R. H. Grant, Superintendent; John J. Grant, General Manager, have been established at Fitchburg, Mass., occupying a building 100x30, with an annex for boiler and engine room. They are preparing to manufacture steel balls for anti-friction purposes, and eventually a general line of machine tools will be produced.

Additions, Enlargements, Removals, etc.:—

Some further additions are to be built to the Farrell Foundry & Machine Co.'s plant, at Ansonia, Conn.

The Hurlburt Rogers Machine Co. contemplates the erection of a new manufactory at Sudbury, Mass.

The Norton Iron Co., of Dorchester, Mass., is reported as to move to more commodious quarters at East Everett.

The Sperl Steam Heater Co., of Susquehanna, Pa., is talking of erecting a new and larger machine shop next season.

The Lexington (Ky.) Foundry Co. will rebuild its plant much larger than the old one, and to pay for the increase it will issue $12,000 or $15,000 of additional stock.

The Wallis Foundry Co., of Girard, O., are making a number of improvements in their foundry, in order to keep pace with the demands made on them for their manufactures.

The Johnson & Rust boot factory, located at Millford, Mass., long idle, is to be occupied as soon as necessary repairs can be made by a new business for Milford. The United States Nozzle & Coupling Co., of Syracuse, N. Y., has leased it to manufacture nozzles and couplings for fire departments' use.

The National Reaper & Mower Co. of Canton, O., propose to remove their plant to Latrobe, Pa., providing a site of 10 acres is donated and $28,000 worth of stock subscribed. The Latrobe Land & Improvement Co. have indicated their willingness to take $10,000 worth of this stock, and an effort is now being made to have the citizens of Latrobe subscribe for the remainder.

Fires and Accidents:—

The Washington (N. C.) Iron Works have been burned, at a loss of $5,000.

The Morrison Foundry, at Stellarton, N. S., has been burned, at a loss of $30,000.

The foundry of the H. B. Smith Co., at Westfield, Mass., has been damaged by fire to the extent of $35,000; insured.

On the 16th the foundry and pattern shop of G. S. Hesker, of Evansville Ind., was destroyed by fire. Loss $40,000; insurance, $11,500.

The works of the Highland Foundry Co., at Roxbury, Mass., have been destroyed by fire. The loss is estimated at $20,000, partly covered by insurance.

The Bain Stove Foundry, at Charleston, Ill., was destroyed by fire on the 20th inst. The loss to the foundry company and adjoining concerns will aggregate $60,000.

The new plant of the St. Lawrence Manufacturing Co., just erected at Irondale, Col., with its entire machinery and stock, has been destroyed by fire. The loss exceeds $30,000, while the insurance is only one-third that amount.

General Industrial Notes:—

The Garfield Injector Co., Wadsworth, O, are sending out a circular cautioning the trade against making, using, purchasing or selling any injector, except the Garfield, containing a tube with a sliding ring forming an automatic valve between the lifting and combining chambers. It says: "The Garfield Injector Co. is the sole owner of the pioneer patent on this construction, and its patent thereon antedates all other patents having a similar combination of parts. It is broadly protected in its right and will permit no wanton violatio nof the same."

A mortgage for $130,000 against Witherow's Works, of this city, which has been on file at the Lawrence County Court House for some time past, was paid off Saturday and the papers destroyed. The firm has had nearly $450,000 due them for work that was completed some time ago, and in order to pay their men and meet other expenses the mortgage was found necessary. Recently they have received part of the outstanding funds, and with this the mortgage as above stated was cancelled. More money is due the firm this week from engines and machinery that have been built for different manufacturing companies, and with these funds in their possession, they will be able to pay off all debts and have a handsome surplus besides. The stories about the company being pushed for funds to meet pressing obligations were without foundation, as for nearly six months there has been $300,000 due them which if urgently necessary could have been collected.—[New Castle (Pa.) Guardian.

Mechanical Moulding Machines.

We learn that mechanical moulding machines are being increasingly adopted in the Staffordshire iron foundry trades. Several patents have been taken out for mechanically preparing the moulds of damp sand, loam and other material for the reception of molten metal. This by machinery can be done much more quickly than by hand, and the consequence is that in this department mechanism is displacing manual labor. The introduction of machinery of this type is a comparatively recent matter, but their growth in favor among the Staffordshire and Warwickshire hardware manufacturers has been rapid, and seems destined to become still more marked in the early future. A new works upon this principle has just been erected at Willenhall, where operations will shortly be commenced. It is anticipated that with the modern improved cupolas a heavy weight of goods will be turned out.—[Glasgow Engineer.

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The Safest, Most Economical, Compact and Durable High Pressure

WATER TUBE BOILERS

All Wrought Steel. Large Mud Drum. Perfect Circulation.

By removing four manhole covers access is gained to every part of the boiler. Dry steam and great economy of fuel guaranteed.

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Works: BARBERTON, SUMMIT COUNTY, OHIO.

THE AETNA MEDIUM & HIGH SPEED ENGINE

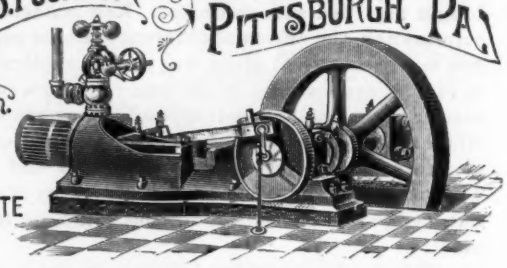
Manufactured by THE TOTTEN & HOGG I. & S. FOUNDRY Co. PITTSBURGH, PA.

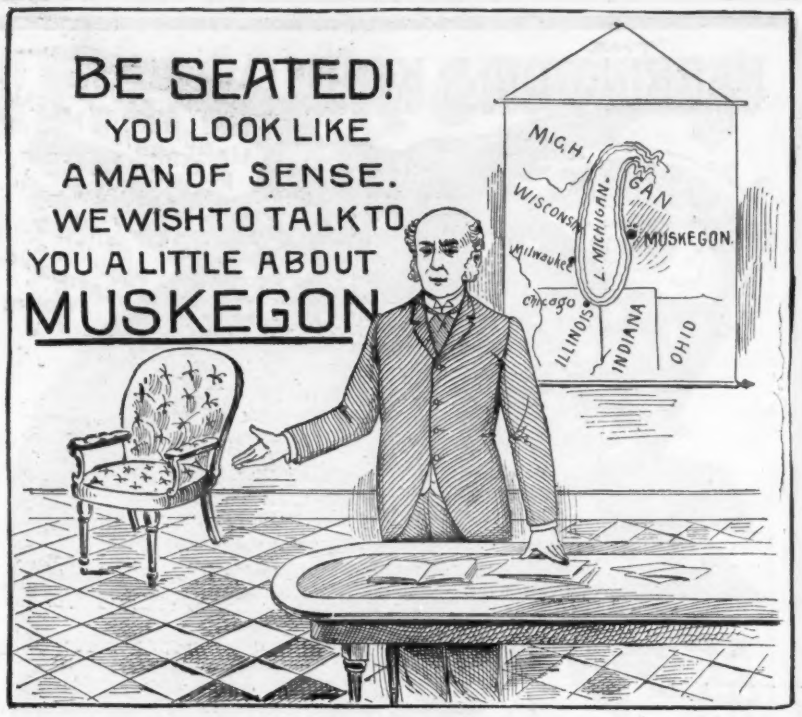
150 to 2000 H.P. Latest Design.

FOR ROLLING MILLS AND ALL OTHER WORKS WHERE LARGE POWER AND CLOSE REGULATION IS REQUIRED

CONTRACTS MADE FOR COMPLETE STEAM PLANTS.

ENGINES ALWAYS IN STOCK.





I wish to say to you that for the Manufacturer or Investor

THE CITY OF MUSKEGON, MICH.,

offers greater opportunities, has more real merit than ANY young City of the United States.

I AM aware that this is a BOLD STATEMENT, but I am prepared to give **Facts and Figures that will astonish you.** Notice this map on the wall, the Lake Michigan District, four States, having a common center (Lake Michigan). These four States, bordering on the **only** great body of water lying **wholly** within the United States, have an average age as States—61 years—and no district of the world ever made such a **record.** These four States: Illinois, Indiana, Michigan and Wisconsin, had, by the census of 1890, 9,781,255 population, or nearly **one-sixth** of the entire population of the Union; they have over **one-fifth** of the railway mileage of the United States, and over **one-tenth** of the railway mileage of the **world;** and talk about rapid growth—**Look at this table:**

NAME OF STATE.	GAIN LAST 30 YEARS.	PRESENT POPULATION—1890.
ILLINOIS	2,106,585	3,818,536
INDIANA	1,514,117	2,189,030
MICHIGAN	1,340,679	2,089,792
WISCONSIN	907,016	1,683 897
TOTAL	5,868,397	9,781,255

This 30 years gain—5,868,397—is MORE than the present ENTIRE POPULATION of the following FIFTEEN STATES, viz:

NOTE:—

MICHIGAN, which is twenty years younger than Illinois or Indiana, made nearly

23 PER CENT.

of the entire gain of this four-state district for the last thirty years.

THE FOUR-STATE GAIN WAS 5,868,397.

The present population of this four-state district is 9,781,255 or MORE than the 22 opposite: ☞

See U. S. Census 1890.

1	California	1,204,002
2	Colorado	410,975
3	Connecticut	745,861
4	Maine	660,251
5	Vermont	332,205
6	New Hampshire	375,227
7	Rhode Island	345,343
8	Delaware	167,861
9	Montana	131,769
10	Nevada	44,327
11	Washington	349,516
12	Utah	206,498
13	Oregon	312,490
14	North Dakota	182,425
15	South Dakota	327,848
	Total	5,796,598
16	West Virginia	760,448
17	Maryland	1,040,431
18	Florida	390,435
19	Idaho	84,229
20	New Jersey	1,441,017
21	Wyoming	60,589
22	New Mexico	144,862
	Total	9,718,609

NOTE.—Michigan gained more population in the last **30** years—see table above—than the present entire population of Connecticut, Vermont and Delaware combined, or within 5,000 as much population as Oregon, Washington, Colorado, Montana and Nevada have combined.

NOTE.—Michigan gained more population in the last **10** years than **Virginia and Georgia** together gained, or than **Kentucky and Tennessee,** or **Alabama and Mississippi** combined gained.

YOU ARE SURPRISED AT THIS.

It was your impression that all the growth and wealth of this district was at the south end of Lake Michigan, but let me tell you right here that the great intrinsic wealth is farther north, in the Iron, Copper, Salt and Timber district. The hardwood forests have scarcely been touched. Michigan puts out yearly over half the Iron Ore mined in the United States; more than all the Southern States combined. Nearly every pound of Steel made in Pennsylvania and Ohio is made from Ore coming from this district, (96.3 per cent of the Steel output of the United States for 1890 is accredited to six States lying along the **Great Lakes**) and this output was 100,000 tons more than that of Great Britain for 1889—**MICHIGAN FURNISHED THE ORE.**

When You Have Absorbed

THE

FOREGOING FACTS AND FIGURES

You are beginning to reach a point where you will appreciate the location of the City of

MUSKEGON.

Notice on this Map on the wall, and in the Cut below,

MUSKEGON'S CENTRAL LOCATION

IN THIS GREAT

TEN MILLION POPULATION DISTRICT.

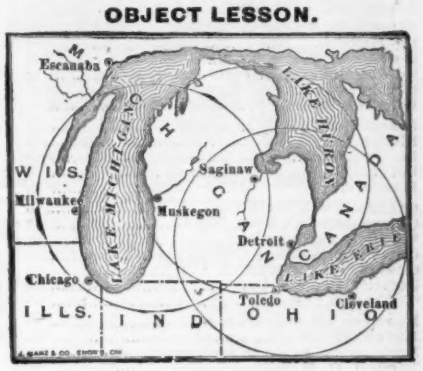
IT HAS THE BEST LOCATION IN MICHIGAN.

LOOK AT THIS!

3 MICHIGAN CIRCLES.
NAVIGATION CITIES.

Radius of Each Circle, 125 Miles.

OBJECT LESSON.



POPULATION:—Each Circle has in round numbers in United States population as follows:

SAGINAW CIRCLE,	1,725,000
DETROIT CIRCLE,	2,600,000
MUSKEGON CIRCLE,	2,725,000

NOTE.—See Cram's Atlas, Census 1890, by Counties.

The great business centers of this Lake Michigan District are the Coast Cities. Muskegon is third in size on this great body of water and has the finest natural inside Harbor on Lake Michigan, sixteen miles of water front, all available, deep water—114 miles from Chicago and 85 miles from Milwaukee, with which two cities **navigation is open the year round.** Only 175 miles by navigation from the greatest **Bessemer Ore** shipping docks in the **world.** Rare combination—**Raw Materials, Best Shipping Facilities and Best Markets** in the United States.

IT IS AN ACTUAL FACT that cargoes of heavy merchandise can be carried from **Muskegon** to the business center of **Chicago quicker** and for **less money** than the same quantity can be brought in **by rail** from points 10 to 15 miles outside the limits of Chicago. No experiment. Doing it now.

These great advantages are beginning to be appreciated. Twenty-one factories have been located in the last eighteen months. Among the factories secured are: **The Alaska Refrigerator Co., Large Rolling Mill, New Steel Works, Chase Bros. Piano Co., Sargeant's Invalid Chair Co., Nelson Piano Co., Mich. Washing Mach. Co., Malleable Iron Works, Machine and Foundry Co., Electric Alarm Co., Shaw Electric Crane Co., Houck Furniture Co., Electrical Power Co., Muskegon Cracker Co., Standard Oil Co. Barreling Works, Morton Key Seating Co., Kelly Bros. Mfg. Co., Heaps Earth Closet Co., Gray Bros. Mfg. Co., Hartshorn Shade Roller Co., New Flouring Mill**—All just completed or now building.

Why do you "CHASE RAINBOWS" on the outskirts of the Country, and invest at high prices, when you can get property near the great business center of the "Central West" for half the money, and having double the intrinsic worth?

A GOLDEN OPPORTUNITY IS BEFORE YOU.

THE MUSKEGON IMPROVEMENT CO., composed of leading citizens, have just commenced their **2nd Great Lot Sale. 2,000 Lots** at the uniform price of **$165 each,** location to be determined by allotment as soon as 50 per. cent. is paid in. **Terms of Subscription:** $15 down, balance $10 each month. $165 secures you a good lot, 50x125 feet, with alley in rear, in the phenomenal addition **"MUSKEGON HEIGHTS,"** which addition is pronounced by Real Estate Experts to be as fine an addition as any city in this country can show. It is less than one and one-half miles from the business center of the City of Muskegon, with which it is connected by handsome, paved streets and an Electric Street Railway. This addition has twelve **large** factories located upon it **now;** has good Hotel, Brick Blocks and Stores, Depot, three paved streets, a large number of good residences. Every lot is level and desirable. **There is not a lot on the addition worth less than the price asked.** The net avails of this sale to be used to locate ten more factories. All the factories on Muskegon Heights are solid, substantial brick structures, the smallest is 50x150 feet, 2 stories; the largest plant is two buildings, each 60x400, one 2 stories, the other 3 stories high; the latter plant is owned by four Bank Presidents and is the largest factory of its kind in the world. **DON'T MISS THIS OPPORTUNITY. Such chances for sure paying investment are rare.**

If you wish to subscribe, remit by Money Order, P. O. or Express, or Bank Draft, to

F. H. HOLBROOK, Sec'y Board of Trade, or

HOLBROOK & McDONALD, SALES AGTS.,

MUSKEGON IMPROVEMENT CO.

REFERENCES: Any Bank in the City of Muskegon. Send for Maps, Plats and Information.

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I have for sale a small MACHINE SHOP with good Tools, now manufacturing specialties and a good jobbing trade offered. LOW RENT. Can work into a big business. Call on or address

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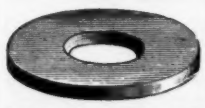
Dealer in Machinery, DETROIT, MICH.



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Even in Gauge, smooth and well finished.

Cut from new plate, rolled expressly for the purpose. ☞Write for prices, Address,

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GRANULATED RAW BONE

For Case Hardening and Coloring

For samples, prices, etc., apply to

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SPICER MANUFACTURING CO.,

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General Foundry and Machine Work, Heavy and Light Castings.

Privilege to make estimates solicited.

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Two 8 inch Mills, with full complement of rolls and guides (54 rolls with each mill,) for making small iron can be seen in position now at the Globe Rolling Mills, Cincinnati, Ohio. Apply to

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Ruled to any pattern.

Best material and workmanship.

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Our corrugated or plain Iron or Steel SHUTTERS and DOORS will render it Fire and Burglar Proof. We also cover wooden shutters and doors with flat painted sheets, either plain or with corduroy corrugations. For prices, etc., address

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ON CANAL ST., CLEVELAND, Adjoining White Sewing Machine Co.'s Plant. About 67 ft front extending back to Valley R. R. tracks. For particulars address

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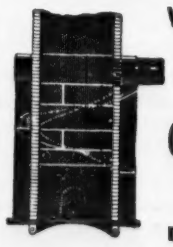

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Improved Patent

HOT BLAST

COLLIAU CUPOLA

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CLEVELAND (f. o. b. cars, net cash) Bessemer, $17 30; No. 1 Foundry, $16 80; No. 2 Foundry, $15 80; No. 1 Gray Forge, red short, $14 80; No. 2 Gray Forge, neutral, $14 30; No. 1 American Scotch, $16 80; No. 2 American Scotch, $15 80.

CHICAGO (reported by Messrs. Rogers, Brown & Merwin): Southern Coke No. 1 foundry, $16 25@17 00; Southern Coke No. 2 Foundry, $15 25@16 00; Southern Coke No. 3 Foundry, $14 75@15 50; Southern Coke No 1, Softeners, $15 25@16 00; Southern Coke No. 2, Softeners, $14 50@15 25; Ohio Silveries No. 1, $17 50@18 50; Ohio Silveries No. 2, $16 50@ 17 50; Ohio Strong Softeners No. 1, $18 00@19 00; Ohio Strong Softeners No. 2, $17 25@18 25; Lake Superior Charcoal Nos. 1 to 6, $17 75@18 50; Tennessee Charcoal No. 1, $18 00@19 00; Tennessee Charcoal No. 2, $17 00@18 00; Southern Standard Car Wheel, $21 00@23 00; Tennessee Standard Car Wheel, $00 00@00 00.

CINCINNATI (reported by Rogers, Brown & Co.): FOUNDRY IRONS—Southern Coke, No. 1 foundry, $15 00@15 50; Southern coke, No. 2 and No. 1 soft, $14 00@14 25; Hanging Rock Coke, No. 1 foundry, $16 50@17 50; Jackson Co. Stone Coal, No. 1 foundry, $16 50@17 00; Tennessee Charcoal, No. 1 foundry, $17 00@17 50; Hanging Rock Charcoal, No. 1 foundry, $20 00@22 00. MILL IRONS—Standard Southern Coke, grey forge, $12 75@13 00; Standard Southern Coke, mottled, $12 50@12 75; Cold Short Southern Coke, grey forge, $12 75@13 00; Strong Ohio Neutral Coke, grey forge, $15 00@15 50. CAR WHEEL AND MALLEABLE—Standard Alabama Car Wheel, $19 50@20 50; Tennessee Car Wheel, $18 00@19 00; Lake Superior Car Wheel, $19 50@20 50.

BUFFALO (reported by Rogers, Brown & Co.): Mahoning and Shenango Valley strong, No. 1 Foundry, $16 25@17 50; Mahoning and Shenango Valley strong, No. 2 Foundry, $15 25@15 50; Ohio Softener No. 1, $16 25@16 75; Ohio Softener No. 2, $15 25@15 75; Jackson Co., Silvery No. 1, $18 00@00 00; Jackson Co. Silvery, No. 2, $17 00@00 00; Lake Superior Charcoal, $18 50@00 00; Tennessee Charcoal, $18 00@19 00; Southern Softener No. 1, $16 25@00 00; Southern Softener No. 2, $15 50@15 75; Southern Strong No. 1 Foundry, $16 75@00 00; Southern Strong No. 2 Foundry, $16 25@00 00. Alabama Car Wheel, $19 75@21 75; Hanging Rock Charcoal, $21 00@22 00.

LOUISVILLE (reported by Hall Bros. & Co.) HOT BLAST FOUNDRY—Southern coke No. 1, $14 25@14 50; Southern coke No. 2, $13 50@14 00; Southern coke No. 3, $13 00@13 25; Mahoning Valley (Lake ore mixtures), $00 00@00 00; Southern charcoal, No. 1, $16 00@17 00; Southern charcoal, No. 2, $15 50@16 00; Missouri charcoal, No. 1, $17 00@17 50; Missouri charcoal, No. 2, $16 50@17 00. FORGE—Neutral coke, $12 50@12 75; Cold short, $12 25@12 50; Mottled, $11 75@12 00 CAR WHEEL AND MALLEABLE—Southern (standard brands), $19 00@19 50; Southern (other brands), $17 00@18 00; Lake Superior, $20 00@21 00.

ST. LOUIS (reported by Rogers, Brown & Meacham): HOT BLAST COKE AND CHARCOAL—Southern Coke No. 1, $15 50@15 75; Southern Coke No. 2, $14 50@14 75; Southern Coke No. 3, $13 75@14 00; Southern Grey Forge, $13 25@13 50; Southern Charcoal No. 1, $17 25@17 75; Southern Charcoal No. 2, $16 75@1 25; Missouri Charcoal No. 1, $15 50@16 00; Missouri Charcoal No. 2, $15 00@15 50; Ohio Softeners, $18 00@19 00. CAR WHEEL AND MALLEABLE IRONS—Lake Superior, $19 50@20 00; Southern, $19 50@21 00. CONNELLSVILLE COKE—East St. Louis, $0 00; St. Louis, $5 65

DETROIT (reported by William F. Jarvis & Co.): Lake Superior Charcoal, all Numbers, $18 00@18 50; Lake Superior (coke) Bessemer, $17 75@18 50; Katahdin (Maine charcoal), $00 00@00 00; Lake Superior Coke, Foundry, all ore, $17 50@18 00; Lake Superior Coke, Foundry, all ore, $00 00@00 00; Standard Ohio Black Band, $18 00@18 50; Southern No. 1 $16 25@16 50; Southern Gray Forge, $14 00@14 50; Jackson County (Ohio) Silvery, $18 25@18 75; Old Car Wheel, $00 00@00 00. Connellsville Coke, $0.00.

LOUISVILLE (reported by Geo. H. Hull & Co.): Southern Coke No. 1 Foundry $14 50@15 00; Southern Coke No. 2 Foundry $13 75@14 25; Southern Coke No. 3 Foundry $13 25@13 75; Grey Forge, $12 50@13 00; Southern Coke Silver Grey, $00 00@00 00; Southern Charcoal No. 1 Foundry, $16 00@17 00; Car Wheel, $18 50@20 00.

PITTSBURGH (reported by A. H. Childs): No. 1 Foundry, $16 00@16 25; No. 2 Foundry, $15 00@15 25; Grey Forge, $13 75@14 00; White and Mottled, $13 00@13 25; Warm Blast Charcoal, $18 00@20 00; Cold Blast Charcoal, $22 00@26 00; Bessemer, $15 25@15 50.

MERCHANT IRON AND STEEL.

Flat Bar

1½ to 4 by ⅜ to 1 inch	1 80
4½ to 6 by ⅜ to 1 inch	1 90
1½ to 6 by 1¼ to 2 inch	2 20
1¼ & 1½ by ⅜ to ½ inch	1 90
1 & 1¼ by ⅜ to ½ inch	2 00
⅝, ¾ and ⅞ by ⅜ to ½ inch	2 20

Round and Square.

1 to 1⅞ inch	1 80
2 to 2½ inch	2 00
2¾ to 3¼ inch	2 30
3½ to 4 inch	2 80
4¼ to 4½ inch	3 30
4¾ to 5 inch	3 50

Oval.

¼ to 1¼ inch	2 20
⅝ to ¾ inch	2 40
⅞	2 60
1	3 00

Half Oval and Half Round.

⅜ to 3 inch	2 90
½ to 1¼ inch	2 50
⅝ to ¾ inch	3 10
⅞	3 30
1	4 80

Heavy Band.

¼ to 6 by ¼ and 5-16 inch	2 00
¼ to 1¼ by ¼ and 5-16 inch	2 10
¼ to ⅞ by ¼ and 5-16 inch	2 30
to 6½ by ¼ and 5-16 inch	3 80

Hoops.

1¼ to 4, Nos. 13 to 15	2 60
1¼ to 2, Nos. 16 to 18	2 70
1¼ to 2, No. 19	2 80
1¼ to 2, No. 20	2 90
1¼ to 2, No. 21	3 00
1¼ to 2, No. 22	3 10
15-16, 1 and 1⅛, Nos. 13 to 15	2 80
15-16, 1 and 1⅛, Nos. 16 to 18	2 90
15-16, 1 and 1⅛, Nos. 19 and 20	3 00
15-16, 1 and 1⅛, No. 21	3 10
15-16, 1 and 1⅛, No. 22	3 20
⅞, Nos. 13 to 15	3 00
⅞, Nos. 16 to 18	3 10
⅞, Nos. 19 and 20	3 20
⅞, No. 21	3 30
⅞, No. 22	3 40
13-16, Nos. 13 to 15	3 20
13-16, Nos. 16 to 18	3 30
13-16, Nos. 19 and 20	3 40
13-16, No. 21	3 50
13-16, No. 22	3 60
¾, Nos. 13 to 15	3 30
¾, Nos. 16 to 18	3 50
¾, Nos. 19 and 20	3 60
¾, No. 21	3 70
¾, No. 22	3 80
11-16, Nos. 13 to 15	3 50
11-16, Nos. 16 to 18	3 70
11-16, Nos. 19 and 20	3 80
11-16, No. 21	3 90
11-16, No. 22	4 00
⅝, Nos. 13 to 15	3 80
⅝, Nos. 16 to 18	4 00
⅝, Nos. 19 and 20	4 10
⅝, No. 21	4 20
⅝, No. 22	4 30
⅝, No. 23	4 50

Light Band.

1¼ to 6 by ¼ to 3-16 in	2 20
1¼ to 6 by Nos. 11 and 12	2 30
1 to 1¾ by ⅛ to 3-16 in	2 40
1 to 1¾ by Nos. 11 and 12	2 50
⅜ and 13-16 by ⅛ to 3-16 in	2 70
⅜ and 1 3-16 by Nos. 11 and 12	2 80
⅜ and 11-16 by ⅛ to 3-16 in	3 00
⅜ and 11-16 by Nos. 11 and 12	3 10
⅜ and 9-16 by ⅛ to 3-16 in.	3 30
⅜ and 9-16 by Nos. 11 and 12	3 40
⅜ by ⅛ to 3-16 in	3 60
⅜ by Nos. 11 and 12	3 70

Wagon Box Iron.

⅛ inch, beveled edge, by Nos. 11 and 12	2 80
⅛ inch, " " " 13 and 14	3 00
¼ inch, " " " 11 and 12	3 10
¼ inch, " " " 13 and 14	3 30

Sheet Iron:

No. 10 to 14	2 65
No. 15 to 17	2 75
No. 18 to 21	2 99
No. 22 to 24	3 15
No. 25 to 26	3 30
No. 27	3 40
No. 28	3 50

Iron Boiler Plates.

Tank, ¼ inch and heavier	2 60
C No. 1, " "	2 85
C H No. 1 " "	3 10
C H Flange, " "	3 85
Extra Flange, "	4 35
Solid Fire Box "	5 10

Steel Boiler Plates—1-4 in. and Heavier.

Tank	2 75
Shell	3 15
Flange	3 45
Marine Flange	3 85
Fire Box	4 55

Above includes plates 90 inches wide.

90 to 96 in. wide	⅜c lb extra
96 to 100 in. wide	1 c "
100 to 104 in. wide	1⅜c "
104 to 116 in. wide	special

American Cast Tool Steel.

ROUND, SQUARE AND OCTAGON.	cts. lbs
1 to 2 in. inclusive	09
9-16 to ⅞ in "	09
7-16 to ⅝ and 2⅝ to 3 in	10⅝
3⅛ to 4 in	11
⅝ to 11-16 and 4⅛	10⅝
⅛ to 6 in	11⅛
¼ to 9-32 and 6⅛ to 7 in	12
5-6 in	14

Flats.

	cts. lbs
2 to 9-16 wide by 2 to ⅛ thick	9

Bessemer and O. H. Steel.

Machinery	base price,	2 75
Tire	"	2 75
Spring	"	3 25
Sleigh Shoe	"	2 75
Toe Calk	"	3 00
Cutter Shoes, tapered and burr.	"	3 00

English Tool Steel.

Jessop's	16c
Hobson's "Best"	16c
" "Choice"	36c

Burden Boiler Rivets.

⅛, ¾, 11-16 and ⅝ inches diameter	4 00
Bridge ⅜, ½, 11-16 and ⅝ inch diam.	4 00

SCRAP IRON AND OLD METAL.

NET TONS

No. 1 R. R. wrought scrap	$18 00
No. 1 wrought scrap	16 50
No. 1 Machine cast scrap	11 50
Iron axles	23 50
Axle turnings	13 50
Wrought turning (free from cast)	11 50
Cast borings	8 00
Uncut wrought iron boilers	11 50
Steel boiler plates	16 00
Grate Bars	8 00
Pipes and flues (Clean)	12 00
Tank iron	12 50
Hoop and band iron	9 50
Sheet iron	8 50
Wrought drillings	11 00
Malleable iron	9 50

Reported by Messrs. BLACK & POLLOCK, Cincinnati, O.:

Railroad Wrought	$20 00
No. 1 Country Wrought	17 00
Stove Plate	8 75
Machine Castings	11 00
Hoop and Sheet	8 00
Casting Borings	9 00
Wrought Turnings	10 00

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Trade Mark Patented.

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DEALERS IN
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J. H. OUTHWAITE & CO.,
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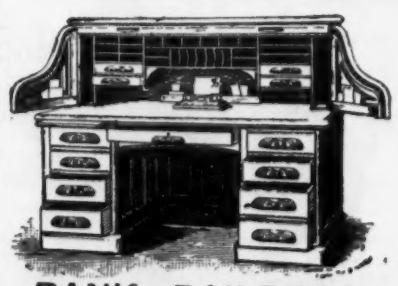

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Anvils.

American.....₩ lb 9@10
Wrights.....₩ lb 12

Bellows.

Blacksmiths' { Hill's.....dis 40 / Bullock's....dis 50&10
Moulders'.....dis 40@40&10
Hand.....dis 40&10@50

Belting.

Boston Belting Co's standard.....dis 70
" " " extra.....dis 60&5
" " " best.....dis 55
Hoyt's Short Lap.....dis 45
Cleveland Rubber Co. extra standard..dis 60&10
Shults Raw Hide Leather Belting, single.....dis 40
Shults Raw Hide Leather Belting, double, and Light Double.....dis 40
Standard, oak tanned.....dis 50&10
Alexander Brothers' pure oak tanned. ...dis 45

Blowers and Exhausters.

B. F. Sturtevant's.....dis 20
Boston Blower Co.,.....dis 35
Buffalo.....dis 35

Borax.

.....₩ lb 12

Chalk.

White.....₩ gross 50
White Crayon.....₩ gross 12@12½ dis 10
Red.....dis 70
Blue.....dis 85

Chucks.

Cushman's 4 Jaw Independent.....dis 45
" Combination.....dis 40
" Geared Scroll.....dis 30
" 2 Jaw Brass Workers.....dis 30
" Drill.....dis 35
Wescott's Scroll Combination.....dis 33⅓
" Independent.....dis 40
" Little Giant Drill.....dis 30
Horton's Universal.....dis 40
" Independent.....dis 45
Whiton's Independent.....dis 45
National Combination.....dis 40
Sweetland " .....dis 40
Almond Drill.....dis 20
Morse " .....dis 15
Skinner's Combination Lathe.....dis 33⅓
" Independent Lathe.....dis 40
" Universal Lathe.....dis 40
" Drill.....dis 15

Cutters and Reamers.

Cleveland.....dis 10@15
Pratt & Whitney.....dis 10@15
Standard.....dis 10@15
Brown & Sharpe, Milling Cutters.....dis 15
Gear Cutters.....dis 15

Crowbars.

Cast Steel.....₩ lb 4
Iron, steel points.....₩ lb 3½

Drill and Drill Sockets.

Twist drills.....dis 50&10
Morse Taper and Straight shank to 1¼".....dis 50&10
Morse Taper and Straight shank Larger than 1¼".....dis 25
Drill Sockets.....dis 25
Standard Twist Drills.....dis 55@55&5
Cleveland " " .....dis 55@55&5

Emery.

	No. 4 to 46 gr.	No. 54 to 150. gr.	Flour, F.	C. F. FF.
Kegs, ₩ lb	4 c	5 c		2½c
½ kegs ₩ lb	4¼c	5¼c		2¾c
¼ kegs ₩ lb	4½c	5½c		3 c
6 lb cans, 10 in case	6 c	6¾c		5 c
6 lb cans, less than 1	10 c	10 c		7¼c

Emery Cloth and Paper.

Barder, Adamson & Co.....dis 45@50
H. H. Barton.....dis 50@50&10

Emery Wheels.

Detroit.....dis 55@60
Norton's.....dis 55@60
Grant.....dis 55@60
Sterling.....dis 60
Celluloid.....dis 10&33⅓
Northampton.....dis 55
Crystal.....dis 65@70
Vitrified.....dis 60
Vulcanite.....dis 10&10

Files.

Nicholson.....dis 60&10@60&10&10
" X. F.....dis 25
Kearney & Foot.....dis 60&10@60&10&10
Black Diamond.....dis 60&10@60&10&10
Arcade.....dis 60&10@60&10&10
Disston's.....dis 65@70
Western.....dis 70
Stub's.....dis 25
Grobet's.....dis 30
Reynolds Bros.' Hand Cut.....dis 50
ndustry File Works, hand cut.....dis 50

Hammers.

P. S. W.....dis 40
Atha new list, Jan. 15, 1887.....dis 50
Heavy hammers and sledges under 5 lbs. 18c over 5 lbs 14c, new list.

Jack Screws.

Illinois Bolt Co. list.....dis 70

Nuts and Washers.

Size of bolt inches	¼	5-16	⅜	½	⅝	¾	⅞	1
Square	8	7	5½	4½	4	3½	3¼	
Hexagon	15⅝	11⅝	8¼	6	5¼	5¼	5	
Washers	9	8	7	5	4½	4¼	4¼	

In lots less than 100 lbs, ₩ lb add ½c., lb boxes add 1c to list.

Nails (wire.

List July 14, 1887.....dis 70 &10
Standard Penny Nails, ₩ keg card rate
Car lots.....$2.30
Less than car lots$2.40

Oilers.

Zinc and Tin.....dis 60
Brass and Copper.....dis 50
Malleable (Hammer's), No. 1, $3.60; No. 2, $4.00; No. 3, $4.40 ₩ doz.....dis 10@10&10

Packing, Steam.

Boston Belting Co.....dis 60
American Packing Hemp.....₩ lb 10@11
Russia Packing " .....₩ lb 14
Italian Packing " .....₩ lb 13@14
Plumbago Piston.....₩ lb 40
Morrison's " .....₩ lb 50
Square Flax " .....₩ lb 50
Sheet Rubber.....₩ lb 12&24
Excelsior Rubber.....₩ lb 48

Picks.

Railroads, 5 to 6 lbs.....$12 dis 60
" 6 to 7 lbs.....$13 dis 60

Pulleys.

Iron Pulleys, Walker List.....dis 45
Medart Pulleys.....dis 55
Split Wood Pulleys.....dis 50@55

Rivets.

Iron, Thousand, list November 17, ...dis 50
Iron, Ordinary, Cooper's Block and Carriage list November 17.....dis 50
Copper.....dis 50@50&10

Rope.

Manilla, ⅜ inch and over.....₩ lb 13¾
Sisal, ⅜ inch and over .....₩ lb 13¾

Sand Paper.

B. A. & Co.....dis45@50
H. H. Barton's.....dis40@45
New England Flint.....dis 40@50
Barton's Garnet.....dis 20

Saws.

Disston's Circular.....dis 40@10
" Band.....dis 20
" Scroll .....Net
Hack Saw Stubs.....dis 20
" " Eureka.....dis 20
" " Star.....dis 20
Saw Swages Disston's.....dis 33
Atkins' Circular Saws.....dis 40&45
" Mill, Mulay and Drag Saws..dis 40&10
" Wood Saws.....dis 40&10
" Silver Steel Diamond Cross-cut Saws.....dis 70c per ft
" Dexter Cross-cuts.....dis 50c "
" Diamond " .....dis 30c "
" Tuttle Tooth Cross-cuts..dis 25c "
" One-man Cross-cuts.....dis 33c "
No. 1 Handles.....dis 25c per pair
No. 6 " .....dis 16c "
Excelsior Saw Tools.....$6 per doz
Perfection " .....$15 "
Detroit Saw Works, Circular.....dis 50
" " " Band.....dis 25
" " " Mulay .....dis 45

Screws.

Wood Screws—New List 1890.

Flat head iron.....dis 72½
Round head iron.....dis 67½
Flat head brass.....dis 72½
Round head brass.....dis 65
Square Cap.....dis 65
Hexagon Cap.....dis 60
Set C. H. C. P.....dis 70
Machine, flat head, iron.....dis 65
Machine, round head, iron.....dis 60
Bench and hand—
Lag or coach.....dis 75@75&10
Coach, patent gimlet point.....dis 75

Shovels and Spades.

Ames' list November 1, 1885.....dis 20
Dennis.....dis 5.25
Hussey & Binns, railroad.....dis 8.00

Taps.

Cards, Hand and Nut to 2 in.....dis 50
Carpenters' " " " .....dis 50
Morse " " " .....dis 50
Pratt & Whitney " " new list dis 10
Machine Screw Taps.....dis 55
Pipe Taps to 2½ in.....dis 70
Stay Bolt Taps.....dis 25
Stove Bolt Taps.....dis 50
Pulley Taps.....dis 40

Twine.

	BC.	B.
No. 12, Flax Twine, ¼ and ½ lb Balls	21c@29c	
No. 18 " " ¼ and ½ "	18c@28c	
No. 36 " " ¼ and ½ "	16c@27c	
2-Ply Hemp, ¼ & ½ lb Balls (Spring Twine	11½c	
3-Ply " 1 lb Balls	12@12½c	
3-Ply " 1½ lb Balls	11@11½c	
Cotton Wrapping, 5 Balls to lb	15@16c	

Vises.

Solid Box.....dis 60
Parker's.....dis 20@25
Prentiss.....dis 20
Stephen's.....dis 25@30
Barrett's.....dis 30
Miller's Falls.....dis 40
Merrill's.....dis 15@20
Howard.....dis 25

Wire.

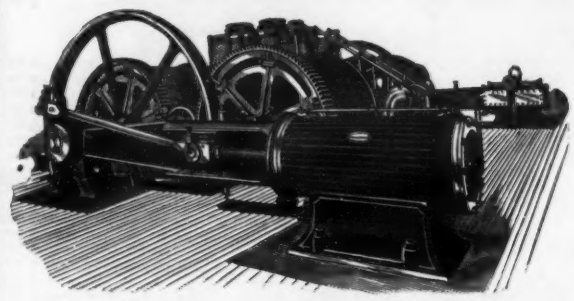
New List, Jan. 18, 1884

Brass and copper.....dis 20@25
Bright and annealed, Nos. 0@18...dis 70&10@75
" " Nos. 19@26..dis 75@75& 5
" " Nos. 27@36..dis 75&10& 5
Coppered Nos. 0 to 18, market list..dis 70@70& 5
Galvanized Nos. 0 to 18 " " .....dis 65&5
Tinned market Nos. 0 to 18.....dis 67½
Cast steel.....dis 50
Tinned Broom Wire.....dis 70&5@70&10
Annealed Fence, Nos. 8 and 9.....dis 75
Annealed Grape, Nos. 10 to 14.....dis 75
Stub's Steel Wire, regular.....$6.00 lb dis 3

Wrenches.

Coe's genuine, ...dis 50
Girard Standard.....dis 70&10
Agricultural.....dis 75&10
Mechanics'.....dis 55&10,& 3
Bemis & Call's Combination .....dis 35
Donohue's Engineers.....dis 20&10
Lamson & Sessions Engineers.....dis 60
Billings & Spencer's Drop Forged.....dis 25
William's " " .....dis 25
Alligator " " .....dis 50

Webster, Camp & Lane Machine Co.



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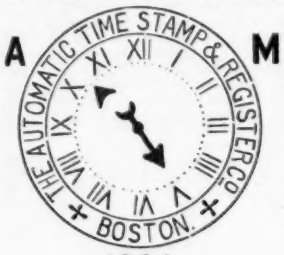

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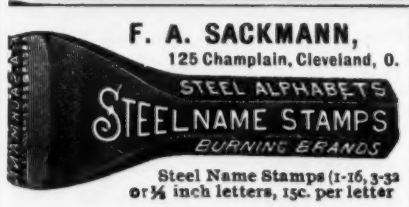

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Price, per set of three, to take from ¼ to 3¼ in. 7 50

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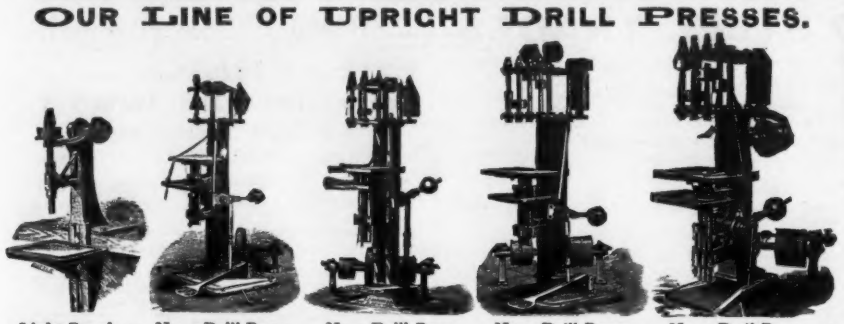

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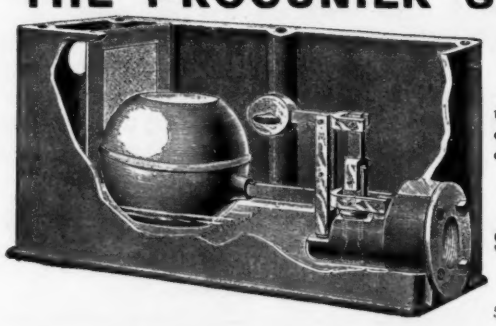

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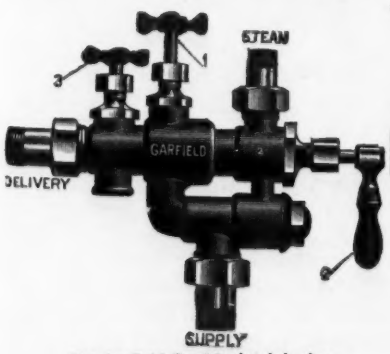

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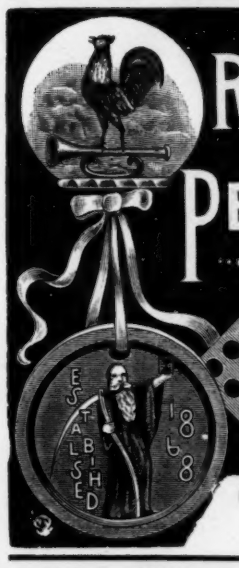

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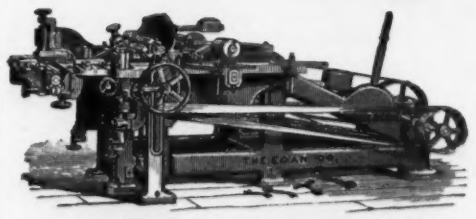

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Cupolas—
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Central Thomson-Houston Co., Cleveland.
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Skinner Engine Co., Erie, Pa.
Westinghouse Machine Co., Pittsburgh.
Southwark Foundry & Machine Co, Philadelphia, Pa.
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Spaulding & Metcalf, Chicago, Ill.
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Parkin & Bosworth Co., Cleveland.
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Cleveland City Forge & Iron Co., Cleveland.
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Cambridge Iron Roofing Co., Cambridge, O.
Garry Iron Roofing Co., Cleveland.
Berger Mfg. Co., Canton, O.
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Kanneberg Roofing Co., Canton, O.
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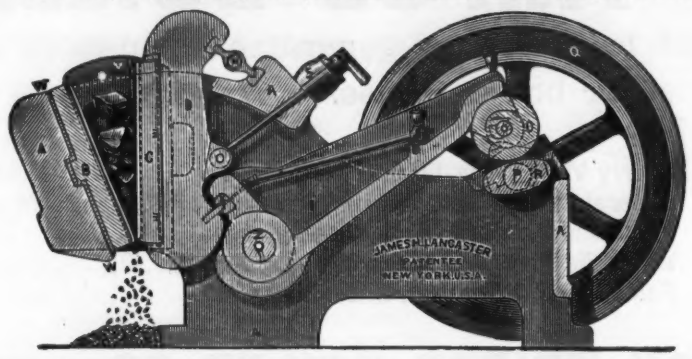

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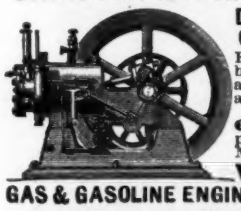

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Fast N. Y. & Pitts. Express*	10 55 a m	*3 00 p m
Mahoning Accommo.....		†6 40 a m
Pittsburgh Express.....	†6 25 p m	
Youngstown Local.....	†8 05 a m	
Mahon'g div. & Pitts Local		*11 40 a m
Mahoning Val. Accom.....		†4 30 p m
Pittsburgh Express.....	‡1 20 p m	11 10 p m
New York Express.....	*8 00 p m	.....

*Daily. †Daily, except Sunday. ‡Daily except Monday.

Cleveland & Canton Railroad.

(Standard Gauge.)

Depart for—

Zanesville and Coshocton—6:50 a. m., 3:00 p. m.
Canton—6:50 a. m., 3:00 p. m., 6:20 p. m.
Kent—6:50 a. m., 3:00 p. m., *5:45 p. m. 6:20 p. m.
Bedford—6:50 a. m., 11:10 a. m., 1:30 p. m., 3:00 p. m., 4:40 p. m., *5:45 p. m., 6:20 p. m. 10:35 p. m.
Newburgh—6:15 a. m., 6:50 a. m., 11:10 a. m., 1.30 p. m., 3:00 p. m., 4:40 p. m., *5:45 p. m., 6:20 p. m., 10:35 p. m.

Arrive from—

Zanesville and Coshocton—10:30 a. m.,6:30 p m.
Canton, 10:30 a. m., 2:35 p. m., 6:30 p. m.
Kent—*8:10 a. m., 10:30 a. m., 2:35 p. m., 6:30 p.m.
Bedford—6:00 a. m., *8:10 a.m., 10:30 a.m., 1:05 p. m., 2:35 p. m., 4:15 p. m., 6:30 p.m., 7:10 p.m.
Newburgh—6:00 a. m., 7:15 a. m., *8:10 a. m., 10:30 a. m., 1.05 p. m., 2:35 p. m., 4:15 p. m., 6:30 p. m., 7:10 p. m.

Trains marked * run daily.

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	Depart.	Arrive.
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Chicago Express	*8 35 a m	* 0 00 p m
Marietta Express.....	†11 15 a m	†2 35 p m
Balto. & Wash. Express.....	*4 00 p m	*10 25 a m
Cleve. and Canton Express	†6 30 p m	†8 20 a m

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	Arrive.	Depart.
For Pittsburgh, Baltimore, Washington, Philadelphia and New York.	d5 25 a m d11 40 a m 6 35 p m	7 45 a m d1 40 p m d11 10 p m
Wellsville, Wheeling and Bellaire.	12 30 p m 6 35 p m	7 45 a m 1 05 p m *11 10 p m
Alliance Accom.....	10 10 a m	3 25 p m
Ravenna Accom.....	8 25 a m	5 00 p m

d Daily. *Excent Saturday Other trains except Sunday. Through Pullman Sleepers to New York on 1:40 p. m. train daily.

From Cleveland Union Station.

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Cleveland & Pittsburgh R. R.

	Arrive.	Depart.
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For Cuyahoga Falls, Akron, Orrville, Millersburg, Gambier, Mt. Vernon and Columbus.	12 30 p m	1 05 p m
For Cuyahoga Falls, Akron, Orrville, Chicago, and all points in the West and Northwest.	5 40 p m 10 10 a m	8 00 a m 3 25 p m

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No. 70, Pittsburgh Accom.....	*11 25 a m
No. 64, New York & Pitts. Limited...	* 2 50 p m
No. 66, Mantua Accommo.....	* 4 20 p m
No. 74, Youngst'n Ex.....	† 6 00 p m
No. 68, New York & Pitts. Ex.....	*11 00 p m
	Arrive.
No. 61, N. Y. & Pittsburgh Express...	† 5 15 a m
No. 71, Youngstown Accom.....	* 7 15 a m
No. 65, New York & Pitts. Lim.....	* 9 55 a m
No. 67, Pittsburgh Accom.....	*12 30 p m
No. 73, Leavittsburgh Local.....	* 2 10 p m
No. 63, New York & Pitts. Ex.....	* 6 50 p m
No, 75, Mantua Accom.....	* 7 20 p m
No. 69, Youngstown Express.....	† 9 10 p m

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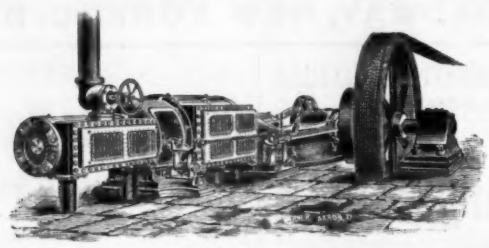

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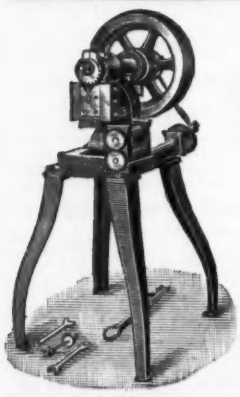

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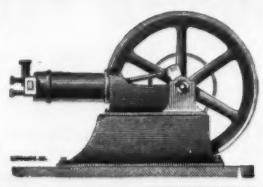

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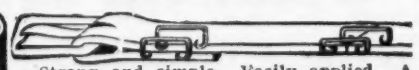

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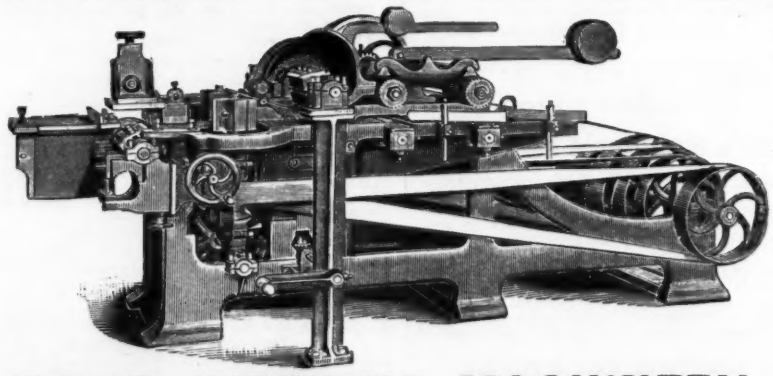

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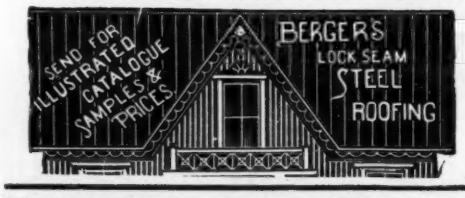

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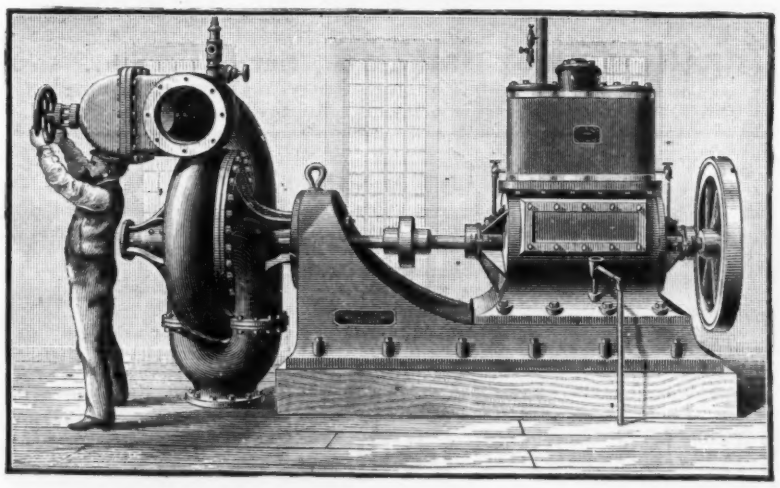

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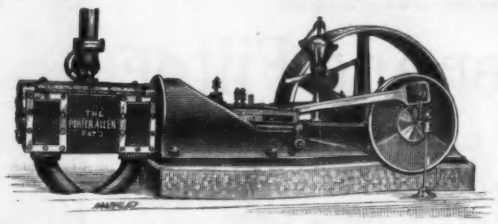

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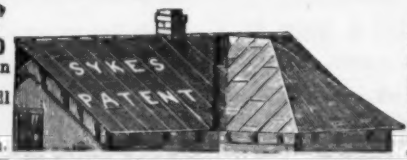

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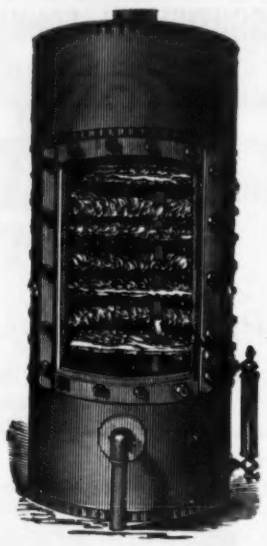

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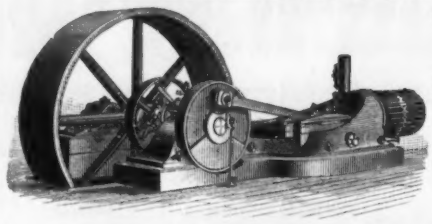

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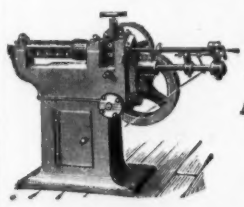

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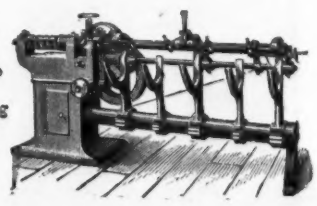

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